सत्यमेव जयते

POWER ECONOMY COMMITTEE

REPORT OF

STUDY GROUP—IV

NEW DELHI

GOVERNMENT OF INDIA
MINISTRY OF IRRIGATION AND POWER

POWER ECONOMY COMMITTEE

RURAL ELECTRIFICATION

REPORT OF STUDY GROUP.—IV

Convener

Shri B. N. Ojha	Member (Thermal), CW&PC (Formerly Engineer Member, BSEB).

Members

Shri L. B. Dudhane	Technical Member, Maharashtra State Elecy. Board
Shri N. Tata Rao	Technical Member, M. P. Electricity Board
Shri A. C. Bandyopadhyay	Managing Director, Rural Electrification Corpn.
Shri P. A. Raman	Technical Director, Rural Electrification Corpn.
Shri A. P. Seethapathy	Officer on Special Duty, Rural Electrification Corpn.
Mr. Lyle M. Robinson	Rural Electrification Specialist, AID/Co-operative Programme.
Shri K. B. Mathur	Director (RE), Central Water & Power Commission.
Shri B. M. Safiulla	Member-Secretary, Southern Regional Elecy. Board (Since retired).

Shri K. L. Vij	Chairman, Power Economy Committee
Shri S. N. Vinze	Member-Secretary, Power Economy Committee

The Study Group is grateful to Shri J. K. Jain, Joint Commissioner (Minor Irrigation), Ministry of Food, Agriculture, Community Development & Co-operation, Department of Agriculture and Shri S. P. Jain, Deputy Director, Central Water & Power Commission for the kind assistance rendered by them in the preparation of this Report.

सत्यमेव जयते

CONTENTS

CHAPTER	SUBJECT	PAGE
I	General Review	1
II	Perspective Planning for Rural Electrification in India and Magnitude of the Task	8
III	Under-ground Water Resources in India	13
IV	Financing	15
V	Economy in Designs of Lines and Sub-Stations	23
VI	Standardisation of designs, specifications of materials and equipments and construction practices	29
VII	Tariff and Incentives for Rural Electrification	36
VIII	Summary of Conclusions & Recommendations	41
	Annexures	43
	Appendix	71

सत्यमेव जयते

POWER ECONOMY COMMITTEE REPORT
OF STUDY GROUP.—IV

SCOPE

Government of India set up a High Powered Committee consisting of experts in the field of electricity development *vide* Resolution No. EL. I. 32(84)/68 dated 27th May, 1969. One of the terms of references of the Committee reads:

> "To review and examine the technical and economical aspects of rural electrification, particularly with a view to enabling the State Electricity Boards and Electricity Authorities to undertake a massive programme of rural electrification and making electricity available at an economical rate."

Study Group-4 was formed to consider and examine the above task in detail. The review of the present position and the measures to be adopted for massive programme of rural electrification in the country are discussed in the Report.

CHAPTER I

GENERAL REVIEW

1.1 India is a predominantly rural country with 80 per cent of the population *i.e.*, four out of every five persons living in 5,66,878 villages. Twenty years ago, electricity was scarce and barely half of one per cent of the villages had the benefit of electricity. The energised pumpsets were very few—less than 19,000. Today 18% of the villages and more than 1½ million pumpsets are electrified.

1.2 Rural electrification is one of our most basic needs. It is an indispensible element in the transformation which has just started in the country's agricultural production. It is one of the most important, nay, the most important tool in the hands of the Indian farmers for bettering their lot. It brings with it social, civic, and domestic amenities to the rural community. Electricity has good psychological effect on the people in the rural areas as they begin to feel themselves belonging to the modern age.

1.3 The Indian farmer, being an astute and intelligent person, intrinsically realised that for lifting water from the wells or streams economically, he can no longer use human or animal power but should change over to electricity for the motive power. Irrigation is important in every land, but more so in India, where rainfall is inadequate for more than 2/3rd of the country. Supply of water in proper time and in adequate quantities is necessary to achieve increased yields brought about by use of improved seeds and fertilizers.

1.4 In many cases, it will not be possible to provide canal waters from rivers by gravity flow due to the high level of the fields to be irrigated. Here we have to lift the water from the rivers. We have vast reservoirs underground yet to be exploited fully. When utilising these water from underground, we have to lift it. Also pumping from wells provide water, for growing two or even three crops all the year round.

1.5 Thus there is a vast field for pressing electricity into service of the farmer. At present we are using less than ten per cent of our electricity for agricultural pumping. This simple use of electricity has alone resulted in a heavy demand. Till 1966, the number of villages electrified were about 44,000 and the number of pumpsets energised half a million. But now (October, 1970), the villages electrified stand in excess of 100,000 and pumpsets energised at one and half million. It is important to note that in a short period of four years, three-fold increase in electrification of pumpsets has been done.

1.6 There is another field where electricity will prove extremely useful. India is richly endowed with reputed crafts and craftsmen in various fields who have rightly earned a name for themselves ever since the ancient times. Due to the traditional unmechanised methods, the rate of their production is slow with the result that the crafts and the craftsmen are unable to compete in today's highly modernised and sophisticated markets and earn a decent living. Electricity provides the incentive for such rural crafts and industries like weaving, pottery, wood work, metal work, etc. and also helps to raise agricultural processing industries such as hullers, flour mills, cold storages, packing industries, etc.

1.7 In short, availability of electricity in the rural areas is bound to be boon to the concerned population in increasing their prosperity and attaining a reasonable level of living. Some states like Punjab and Tamil Nadu provide excellent examples of using electricity in villages for agriculture and small scale industries.

1.8 Electricity also helps to raise education standards by providing better illumination facilitating studies, enables provision of municipal services like street lighting, drinking water supply, and in numerous ways helps to reduce the unemployment problem.

1.9 There is one other aspect which deserves attention. In the absence of an important amenity like electricity, the villagers migrate to towns. This results in overcrowding. When a man comes to town, he costs a lot more, as the problem of water supply, sanitation and housing becomes multiplied. Therefore in the best interest of the country, we have to stem the migration from the rural areas and people in the villages should be encouraged to stay where they are and this is possible only if a basic necessity like electricity is provided.

1.10 Realising the tremendous impact of electricity on the rural population, India is now engaged in further accelerating the pace of rural electrification. In the first three Plans, ending with March, 1966, the total money spent on rural electrification was hardly Rs. 227 crores. In three succeeding years alone, the investment has exceeded the total of all the three Plans and nearly Rs. 180 crores were spent. For the Fourth Plan ending with March, 1974, the investment is to be Rs. 520 crores, that is, a little less than the amount spent in the previous two decades.

1.11 In Germany, a relatively small labour force in the agricultural sector produces so much food that they are nearly self-supporting. In the U.S.A. less than 7% of the population engaged in farming not only produces enough food for the country, but also a large surplus which is exported. On the other hand, in India, about 80% of the population work directly or indirectly in the agricultural sector but the output of farming is low. Generally, it does not rise above low level subsistance farming except a few areas like Punjab. Amongst various reasons the one important factor as to why the productivity of farming has been low in this country is on account of *energy and motive power* having not been applied on a large scale to farming in the past as in the developed countries.

1.12 The expected food grain production by the end of 1975-76 to attain minimum daily requirements is estimated to be of the order of 130 million tonnes against the production of about 100 million tonnes in 1969-70. This could be achieved only through extensive irrigation, installation of pumping sets and by adopting the improved agricultural practices including the use of improved seeds.

1.13 Agriculture accounts for about half of India's national income and also for half of India's foreign exchange earnings. 158 million hectares of land out of the total geographical area of 327 million hectares in the country is presently under cultivation. In spite of the fact that all the requisites of resourceful agriculture are available in abundance in India the yields of most of the crops are very low. One of the chief reasons for low production is inadequate irrigation facilities. During recent years, the use of high-yielding varieties of food crops and use of fertilizers and irrigation waters in sufficient quantities have clearly indicated that food production in India can be increased many fold. It is here that rural electrification can play an important role by increasing the number of tube-wells/pump sets in the country. In regions, where sufficient under-ground water is available, tube-wells can be very profitably employed for irrigation purposes. It may be worthwhile to note that the average cost of water from tube-wells based on a power rate of 15 paise per Kw hr. is Rs. 3.5 per 100 cu. m. (16 paise per 1,000 gallons). In the power cost range of 10-15 paise per Kw hr. energy represents about 40 to 50% of the water cost.

सत्यमेव जयते

1.14 The agriculture sector is not only the major source of foreign exchange to finance imports and capital investments, but also the largest potential market for the industry. Only balanced growth between agricultural and industrial sectors guarantees economic development. Electric power is one of the best means for increasing the productivity of human labour inside the farm, in the kitchen, stables, workshop and elsewhere. The substitution of non-commercial forms of energy, such as wood, vegetable waste, cattle dung, animal and human power, which are at present used to provide energy in rural areas, would also considerably further and accelerate economic growth. The extensive use of wood cause problems of soil erosion and the use of vegetable waste and cattle dung withholds from the land an important source of manure. It has to be remembered that animals and human-beings are very ineffective convertors of energy.

Much land is required to maintain the animals when this land could profitably be utilised for increasing food production for the growing population.

1.15 The number of villages electrified during the three plans and during the years of 1966-67 to 1969-70 is given in Annexure I. The total number of villages electrified till the end of March, 1970 was 90,258. The number of villages electrified till the end of October because of the tempo created owing to Gandhiji's Birth Centenary rose to about 100000. The total number of villages, in India, is 5,66,878. The number of irrigation pump sets energised state-wise and in the Union Territories is indicated in Annexure II. The total number of pump sets energised as on 31-3-1970 was about 13.54 lakhs as against about 5.13 lakhs energised by the end of the Third Plan. It would, therefore, be observed that because of the emphasis laid on the energisation of pump sets from the beginning of 1966-67, there has been a remarkable progress in the programme of providing irrigation facilities through rural electrification. It would be seen from Annexure III that the average population served by the electrified villages is about 35 per cent at present. Annexure IV gives information regarding electrification of towns and villages in some of the countries of South East Asia.

1.16 The return on investment on rural electrification is generally low. This is because villages are flung apart and transmission lines have to be taken to long distances for comparatively small loads. Not only the loads in rural areas are much smaller than in urban areas, but power is required only for a few hours. Particularly, if the power is taken for agricultural pumping only, it is of rather seasonal nature and the overall utilisation is very low. All this would mean that the consumption of electricity in rural areas, especially in the initial years, will be low, when compared to the investment required to be made, and the return, therefore, will be inadequate for meeting interest charges on the capital investment. That is why, even in a rich and highly developed country like U.S.A., in encouraging spread of electricity in rural areas, money is advanced to rural co-operatives at low interest rate of two to three per cent.

1.17 Rural electrification schemes are proposed by the State Electricity Boards and the yardstick that is generally applied is the financial return on investments involved. But in this manner, numerous other advantages—social, economic, and others are lost sight of. It is a well known fact that rural schemes take a few years to become economically viable in general terms of financial returns. However, when numerous other advantages are considered, the schemes perhaps start paying handsome dividends much faster. In order to examine the socio-economic benefits, referred to above, a study of the impact of rural electrification in Punjab was taken up by the National Council of Applied Economic Research and the results of this study are contained in their publication, entitled "Impact of Rural Electrification in Punjab", May, 1967. A summary of the important findings is given below:

"Extent of Rural Electrification in Punjab:"

Punjab made a remarkable progress in providing electric power in villages since the inception of the First Five Year Plan. The percentage of villages electrified in Punjab as on 31-3-1965 stood at 24.18 compared to the 0.35 of villages electrified as on 31-3-1951.

Financial Position of the Rural Electrification Schemes in Punjab

The estimated gross revenue from the consumers of electricity in rural areas in Punjab as percentage of the capital cost of rural electrification worked out to 29.12 per cent. The operating and maintenance expenditure on the rural electrification schemes is estimated at about 27 per cent of the gross revenue. Thus, in the net, the rural electrification schemes in Punjab have proved to be financially viable.

However, the analysis of the data on the average revenue and cost of rural electrification reveals that the percentage of gross revenue to the capital invested is very small (only 9%) for villages which had been electrified for only one year or less. Even for villages which had been electrified for two to four years, the percentage of gross revenue collected to the total capital invested is not high. Only in the case of villages which had been electrified for five years or more, the gross revenue and the operating and maintenance expenditure including cost of power, depreciation, etc., break even. Presumably, the case is strong for subsidising rural electrification schemes in an initial period of upto five years.

It has also become significant that as the distance of the villages from the nearest town increases, the percentage of gross revenue to the capital invested decreases.

Analysis of the data by the connected load showed that for small loads below 50 KW rural electrification appears to be a losing proposition.

Impact of Electricity on Agriculture :

Of the selected pump set/tube-well users, 9.6 per cent reported that they were using diesel pumpsets, 11.7 per cent reported their dependence on canals, 83.6 per cent on wells, and 3.5 per cent reported no irrigation prior to electrification.

After electrification, there is an increase on an average of 7.63 acres of gross irrigated area per user of pump set/tubewell. Of this, the largest proportion is under wheat crop, with sugarcane taking the next important place.

The additional income realised by the pumpset/tubewell user, thanks to electrification, works out to Rs. 237 per cultivated acre. But the benefit derived by the user of electricity for pumpset/tubewell seems to increase as the size of the village decreases. Thus in a village with a population of less than 1000 this works out to Rs. 256 per cultivated acre per year compared with Rs. 120 in a village with a population of 5000.

Further, it is seen that longer the village has been electrified, the greater the benefits that flow from it by use of pumpsets and tubewells. The average additional income realised by the pumpset/tubewell user per crop year, (after electrification) in villages, which are electrified for a period of less than a year, is Rs. 1544 (which is Rs. 71 per cultivated acre) compared to the average additional income realised by the pump set/tubewell user in villages which are electrified for five to nine years, which is Rs. 4625 (i.e. Rs. 160 per cultivated acre) and in villages electrified for 10 or more years it is Rs. 10,251 (i.e. Rs. 475 per cultivated acre).

All this would imply that, although the revenue realised by the State Electricity Board in smaller and remote villages is not satisfactory immediately, the benefits realised by the farmers in smaller villages are relatively high, and in the long run the schemes would be paying as well. For this reason there seems to be a case for providing electricity to smaller villages.

Saving and Better Utilisation of Animal Labour :

About 90 per cent of the farmers using electricity for pumpsets/tubewells reported the release of bullocks from irrigation labour as a consequence.

On an average, a pumpset/tubewell user saved 354 bullock labour days per crop year. The value of the average saving in bullock labour worked out to Rs. 712 per crop year.

Saving and Better Utilisation of Human Labour :

About 63 per cent of the farmers using electricity for pumpsets/tubewells reported the release of family or hired labour from irrigation tasks as a consequence. Of these 35.2 per cent reported that the persons thus released from labour were absorbed in other agricultural operations, while 11.9 per cent reported that the surplus labour was transformed to business.

Consequent on the introduction of power in irrigation a farmer using pumpset/tubewell in Punjab saved about 357 days of family or hired labour valued at Rs. 1017.

Impact of Electricity on Rural Industries :

About 68 per cent of the industrial units interviewed reported that they would not have come into existence but for the extension of power lines to the villages in which they are located. About 6 per cent of the industrial units reported that there was a reduction in the use of kerosene oil after they had switched over to the use of electricity; 1.2 per cent reported a reduction in the use of high speed diesel oil and 15.7 per cent in the use of light diesel oil. Eight per cent reported the release of family or hired labour after they started using electricity in their units.

On an average, the net income of an industrial unit has increased by Rs. 1602 per annum after electrification. The addition to net income of an industrial unit in a small village (of less than 1000 population) is relatively high compared to that of a unit in big villages. This implies that there is some economic justification for providing electricity even to small villages.

Value of the Commercial Fuel Saved :

On an average, the industrial user of electricity saved of commercial fuel at Rs. 2417/- per annum after switching over to electricity.

Impact of Electricity on Domestic Users :

In money terms the benefits from rural electrification in Punjab worked out to Rs. 105/- per annum per domestic user.

Prior to electrification nearly 99 per cent of the domestic users of electricity were using kerosene oil for lighting. In addition to the use of electricity for lighting by them 42.5 per cent are using electricity for radios, 31.9 per cent for fans, and 9.8 per cent for ironing.

Saving in the use of Kerosene Oil for Domestic Lighting :

With the advent of electricity the quantity of kerosene oil saved per domestic user is estimated to be 43.63 litres.

Saving on account of using electricity for operating Radios :

6.52 per cent of the domestic users of electricity in the villages of Punjab have reported to be using battery operated radios prior to electrification; all of them have since switched over to electricity. The amount saved by the switch over to electricity for radio sets works out to Rs. 63.24 per year.

Impact of Electricity on the Working Hours :

On an average the advent of electricity has gained for the villager 1.72 additional working hours per day. Of the households engaged in certain gainful activities, 46.8 per cent reported that the extra hours thus gained were spent in weaving; 26.1 per cent in agricultural operations; 2.3 per cent in poultry keeping; 1.2 per cent in small-scale industries like pottery, mat-making, etc., 0.67 per cent in the carpentry; 0.43 per cent in rearing birds; 0.18 per cent in fishing and 19.8 per cent in other unspecified activities.

Increase in the Reading Habits :

The additional time gained for reading is estimated at 1.83 hours per day.

Effect of Electrification on Security :

About 80 per cent of the domestic users have reported that they experienced a better sense of security after electrification.

Effect of Electrification on the Chances of Fire :

About 90 per cent of the domestic users of electricity indicated a decrease in the chances of fire after electrification.

Impact of Electricity on commercial users :

Commercial establishments in rural areas of Punjab have on an average benefitted to the extent of Rs. 532/- per annum as a result of electrification.

Impact on the participation of people in Community Institutions :

After electrification, in 15.8 per cent of the villages there has been an increased participation in the activities of Panchayat Ghars, in 11.9 per cent of the villages there is an increased participation in the cooperative institutions and in 4.2 per cent of the villages, an increased participation in the activities of Mahila Mandals.

Almost 34 per cent of the villages reported to be having medical facilities available during late hours in the night after electrification.

Reduction in the migration of educated youth from Rural to Urban Areas :

In 23 per cent of the villages which are electrified there has been a reduction in the migration of educated youth from rural to urban areas.

About 5 per cent of the electrified villages have reported that the educated youth find it attractive to live in villages after electrification.

Additional employment opportunities available :

"After electrification, on an average about 6 persons per village found employment in seasonal jobs while 13 persons per village found employment in permanent occupations."

1.18 At the request of the Government of India and the State Government, the National Council of Applied Economic Research carried out a similar study to assess the impact of rural electrification in Kerala in 1968 on agriculture in terms of observed changes in the irrigated area and the crop pattern as well as of industries in the rural areas of the State. It was intended to find out the economic advantages to rural Kerala due to the use of electricity compared to the alternative methods available to the electricity users. The results of these studies are summarised below:—

"*Impact of Electricity on Agriculture:*

The impact of rural electrification on agriculture can be judged by the changes in the cropping pattern and by the introduction of new crops, if any, after electrification compared to the position before. The data collected by N.C.A.E.R. showed that prior to electrification, the cultivators could irrigate on an average only 1.44 hectares whereas after electrification they could irrigate about 3.01 hectares on an average. This relative increase in the gross irrigated areas of the users of electricity is found in all sizes of groups of cultivators. In the case of farmers cultivating less than one hectare, the irrigated area under paddy after electrification increased from 0.08 hactare to 0.65 hectare. Cultivators having a paddy holding of more than one hectare unit and less than 5 hectares could irrigate 1.94 hectares instead of only 0.92 hectare prior to electrification. Cultivators with above five hectares unit and less than 10 hectares could irrigate 5.94 hectares under paddy after electrification compared to the irrigated area of 3.33 hectares before. In the size group of 10 to 25 hectares, cultivators could irrigate nearly 23.6 hectares after electrification compared to 14.8 hectares earlier.

Impact of Electricity on Rural Industries:

The availability of electricity in rural areas have an impact on the industries located in the villages in two ways. Firstly, the traditionally operated units in villages may change over to the use of electric power and secondly, new industries operated by electricity may come up. Besides, the use of electric power can result in the reduction of certain cost items in industries such as labour, fuel thus leading to an increase in the profitability of the industrial units. The sample survey in all the 9 districts of Kerala showed that in the selected electrified villages, a large number of new industrial units had been established after electrification.

In the industrial sector, the predominating types of industries located in the selected samples of electrified villages and non-electrified villages in the State are flour mills, rice mills, rice and flour mills, oil mills, saw mills and tile manufacturing units. The annual cost of power incurred by a flour mill using electricity was found to be Rs. 656/- as compared to Rs. 811/- for a mill not using electricity. A rice mill using electricity reported the cost of power at Rs. 723/- and a rice mill not using electricity Rs. 1623/- for fuel. The average annual cost of operation of a flour mill using electricity was Rs. 1604/-, against Rs. 2842/- for a flour mill using diesel oil. The average cost of operation per kilogram of wheat grounded was 12 paise in the case of a diesel oil flour mill and 7 paise in the case of flour mill using electricity.

The average cost of power by an household was relatively high compared to the average cost of oil. However, the advantages of the use of electricity for domestic purposes cannot be valued in strict quantitative terms. The numerable benefits of advantages of better living, better security and convenience etc. cannot be measured in monetary terms, but they are available to the domestic users of electricity.

1.19 Another point worth noting is that whenever any rural area is electrified, the experience is that the value of land and buildings increases many times. This confers great financial benefits on the property owners.

1.20 From the studies made by the National Council of Applied Economic Research, it is obvious that rural electrification bestows enormous advantages in agriculture industry, socio-economic, general etc. The N.C.A.E.R. have made out an exhaustive study after evaluating the indirect benefits referred to above and found that in the case of Punjab the benefit-cost ratio of all the rural electrification schemes was well above unit which proves that the schemes undertaken are economically justifiable. It is, therefore, suggested that in future, in addition to making an appraisal of financial returns, the cost-benefit ratio of different rural electrification schemes should be worked out and this should be taken into consideration while considering schemes for execution. It may be pointed out that the cost-benefit ratio method is also applied in the evaluation of irrigation schemes at present and there is no reason as to why the same should not be applied to rural electrification schemes which involve electrification of pumpsets, the main purpose of which is to provide irrigation. An interesting feature of the analysis of the cost-benefit ratio by size of the electrified village is that although the gross receipts as a percentage of the total capital investment for the electrification of small villages (of less than 1,000 population) is much less than the yard-stick of 18% adopted by the Punjab State Electricity Board, the benefit-cost ratio for the villages within the group (less than 1,000 population) is much more than the cost-benefit ratio for the villages of bigger size. In considering the economic feasibility of electrification of villages, this aspect is also important. In this connection it may also be stated that Tamil Nadu has registered phenomenal progress in the recent years in the field of connecting pumpsets to give a boost for the food production. The State which has been a pioneer in the development of electricity in early part of the twentieth century is also a pioneer in extending power to the rural areas of the State and has been following progressive policies in this behalf. This progress in the field of rural electrification is in no mean measure due to the policy of evolving commercial proposals for extension of supply to the pumpsets, street lights etc., on gross return basis and the minimum return fixed for taking up the work of extension is 10 per cent. For any scheme to become viable, the cost of O & M expenses, depreciation and interest on loans taken, etc., must be taken into consideration and the minimum return required will work out to be about 25 per cent. Knowing that the State has lot of load potentiality the Board as a commercial concern has taken the risk of taking up the work with a return of 10 per cent anticipating the load growth to provide the balance of 15 per cent in a few years.

1.21 A questionnaire regarding Rural Electrification in the States was circulated to the various State Electricity Boards. The replies received from some of the States are enclosed at Appendix I.

सत्यमेव जयते

CHAPTER II

PERSPECTIVE PLANNING FOR RURAL ELECTRIFICATION IN INDIA AND MAGNITUDE OF THE TASK

2.1.1 The importance of electricity has special significance as one of the effective catalysts and driving force contributing to the promotion of economic development. Till recently, the major part of the beneficial effects of electrification were thought of only in terms of achieving far-reaching changes in conditions for the progressive growth of various industries and commerce and for providing essential amenities generally associated with the development of urban areas. This was felt so because the wider use of electricity increases industrial production and raises living standards of people in the country. But with the growing realisation to achieve economic betterment and social development in the rural areas—so far neglected sector of the agriculture-oriented economy it has come to be widely believed that by making provision of electric power in rural areas to maximise use of ground water potential to increase agricultural production, would also help to bring 'urbanism' and rapid changes in rural communities. With the increasing potentialities of rural power for gearing up rural development and boosting agricultural production, the tool of rural electrification has become rather indispensable for rapid rural upliftment.

2.1.2 To hasten technological revolution in the agricultural sector, rural electrification provides the necessary stimulative effect. Also, it helps development and expansion of agro-based small and medium industries, in addition to other industries, to bring about effective changes in rural socio-economic life.

2.2 Need for Perspective Planning in Rural Electrification

2.2.1 With the gradual progress of formulation and implementation of Five Year Plans in India, an immediate need was felt to draw out a perspective plan for the core sectors of economy. In pursuance of this need, the Planning Commission published a document in 'Notes on Perspective Development in India 1960-61 to 1975-76.' To achieve rapid rate of growth for the whole economy, an impression was created that alongwith the formulation of perspective plan for the core sectors like agriculture, irrigation and power, and industry etc. such plan should be prepared for sub-sectors also. One such field was electrification in rural India.

2.2.2 Prior to development planning in India, the pace of electrification was mainly confined to urban areas for use as public utility services and also for development of basic and core industries. The programme of rural electrification gained momentum only with the initiation of the process of development plans in the country. The table 1 below gives details of progess in rural electrification through the Five Year Plans and during the period of 'Plan Holiday' of three years when only annual plans were formulated for implementing rural electrification schemes.

TABLE—I

Progress in Rural Electrification and Pumpsets Energisation under the Five Year Plans and Annual Plans

	Outlay (Rs. crores)	No. of villages electrified (Cumulative)	No. of pump sets Energised (Cumulative)
I. Pre plan . . .	10	3,623	18,709
II. First Five Year Plan	27	9,609	51,969
III. Second Five Year Plan	75	25,453	1,92,876
IV. Third Five Year Plan	125	44,494	5,13,021
V. Three Annual Plans (1966-67 to 1968-69)	180	71,410	10,88,696
VI. Fourth Five Year Plan	520	1,25,000*	26,00,000

*Estimated.

2.2.3 From the available data, it appears that before the commencement of First Plan, very insignificant attention was paid towards the progress of rural electrification in India. First attempt was initiated during the First Five Year Plan period, when a modest provision of Rs. 27 crores was made to meet the demands of a few progressive state *viz* Mysore Tamil Nadu and Kerala. As table I shows, this resulted in the electrification of only 5,986 villages. The programme of rural electrification become cognisable only during the Second Five Year Plan period. The major break through was achieved during the Third Plan period, when an outlay of Rs. 105 crores was made and the actual expenditure went upto Rs. 125 crores. Resultantly, as against the target of electrifying 40,000 villages, the number of villages covered went upto 44,454 in number. During the Annual Plans, 1966-67 to 1968-69, this programme was given a further fillip which resulted in electrification of additional 26,916 villages.

2.2.4 For the "total" electrification, the target before the country will be to electrify 5,66,878 villages over the coming years, the achievement till the beginning of development planning was a meagre 0.6 per cent of the total number of villages. From the latest statistical data available, this percentage through the process of continuous emphasis and rigorous planning has gone upto about 18 per cent, But still magnitude of the task is tremendous and it requires the necessary perspective planning for rural electrification to provide rapid progress in this field. As the development plan for rural electrification for the Fourth Plan i.e. 1969-74 has been drawn, in order to formulate a perspective plan for the period 1971-72—80-81 it is only essential that a period of 1974-81 should form part of the perspective plan for rural electrification. Formulation of such a perspective plan for 7 years period would help to present picture from 1971 to 1981.

2.3 Perspective Planning for Rural Electrification 1973-74—80-81 :

2.3.1 It is broadly agreed that the National Plan for rural electrification embracing electrification of all the villages in the country and energisation of the envisaged number of pump sets would require a minimum 20 years period or more starting from 1973-74 onwards. To draw up a perspective plan for the 7 years period, i.e. 1974-81, a tentative programme and relative costs need to be worked out.

2.3.2 Broadly speaking, at the end of the Fourth Plan, electric supply would be extended to about 1,25,000 villages out of a total of 5,66,878. In the ground water irrigation sector, out of a total of about 7 million wells and tubewells likely in use by 1973-74, about 2.6 million would have been provided with electric pumpsets.

2.3.3 To draw a programme of electrification of wells between 1974-81 under the Seven year perspective plan, an assessment is to be made of the total number of irrigation wells and tubewells which are likely to be in use in the country at this time. The ultimate potential of irrigated area from ground water resources is 22 million hectares. Out of this, the utilisation by 1968-69 has been 10.9 million hectares only leaving a balance of about 11 million hectares to be covered in the future plan periods. It may be assumed that the energisation of pumpsets installed in dug wells and tubewells should cover approximately one-third of this irrigation potential by 1980-81 including a small part for irrigation by animal power, diesel pumpsets, etc. These diesel pumpsets which number around 6.4 lakhs at present and are expected to increase by another 6 lakhs during the Fourth Plan period, may gradually ask for electric connections in view of the expansion of the grid mains and high cost involved in operation of diesel pumpsets. However, there will be substantial number of diesel pumpsets which will remain in use in far off and isolated areas when power supply will not be available. Also, animal power may still continue in use as every dugwell may not be fit for provision of a pumpset due to the inadequate water availability and other similar reasons.

2.3.4 The working group on Minor Irrigation and Rural Electrification for the Fourth Plan, has assumed a provision of 10 lakhs dugwells, 3 lakhs private tube-wells and about 6,000 State tubewells. If these figures are assumed to remain more or less at that level in the subsequent seven year plan period, i.e. by 1980-81, there should be roughly 3.5 million dugwells, 0.6 million dugwells, 0.6 million private tubewells and about 15,000 State tube-wells to be taken care of. In this context, however, it may be noted that there is a substantial depreciation on such works (about 0.5 million acres of irrigated area per year under present conditions). This is mainly due to the discharge from tubewells getting reduced due to gradual deterioration of the strainers and several dugwells failing after a number of years of use, etc. Thus, it may be assumed that the total number of dugwells in actual use may be substantially less than the total number as indicated earlier. Allowing for this substantial depreciation, we may assume that around 3.0 million dugwells are likely to be in use in 1980-81, out of which a substantial part would have been fitted with electric pumpsets. For the present estimates, it is assumed that approximately 2.4 million of these wells will have electric pumpsets and the remaining 0.6 million will continue to run either with diesel or animal power. Similarly, about 0.4 million private tubewells and 11,000 State tubewells have been allowed for and all these will be operated by electric pumpsets.

2.3.5 This period of 1974-81 may, therefore, cover broadly an estimated additional electrification of 1,40,000 villages and energisation of around 2 4 million pumpsets.

2.3.6 Having in view the above programme, it will be easier to cover a much bigger programme of rural electrification as development takes place from plan to plan. A rough plan-wise programme for 7 years period from 1974-1981 could be as below :—

		Seven years plan 1974—1981
I. Elecrrification of villages .		1,40,000
II. Electrification of pumpsets		
Dug wells .	24,00,000	28,11,000
Private tubewells	4,00,000	
State tubewells .	11,000	

Source of Power

2.3.7 The source of power for meeting of load demands in the rural areas has an important bearing on the speed with which the rural areas could be electrified in any large programme. The cost of power being a good part of the total running charges, a large programme should aim at the lowest possible cost. The cheapest source of power in any rural electrification programme should aim at the lowest possible cost. The cheapest source of power in any rural electrification programme is possible through a back-bone of transmission and feeder lines forming part of an extensive Grid. The grid may be fed entirely from the thermal or hydel or nuclear power stations or a good mixture of these which will be the order of the day in the future plans. The main transmission lines should normally be intended for distribution of power for the more important and remunerative industrial loads. The rural loads will be tagged on to the system by suitable small extensions. The capital investment involved on such small extensions will be only a small fraction of the cost involved for supplying electricity to the villages by other independent sources. There has been rapid progress in the rural electrification programme in the State where such a backbone of main grid lines was available.

2.4 Isolated Small Pilot Generating Plants :

2.4.1 The major part of serving the villages would be by way of grid mains extension as explained above. However, there may be some isolated villages here and there which will not come within the economic reach of the grid mains for some time to come. In order to cover such a contingency, provision of small pilot diesel generating stations to serve these villages and for the development of load for such areas may have to be made. This is only a short term measure till such time as the grid main supply is extended to these places. Similar provision may have to be made here and there for micro hydel stations which will serve almost the same purpose as isolated diesel generating stations. Wind power plants as a source of power may also be encouraged in places where these are feasible. The impact of the diesel, micro-hydel and the wind power stations in any large coverage of rural areas is small. These may be left for consideration for a rough programme to be chalked out for the future plan period. Consideration may be given only to extension of grid mains.

2.4.2 At the end of the Fourth Plan there will be enough of grid mains to embark upon an ambitious programme of rural electrification both to serve the needs of the villages and to serve the irrigation sector for agricultural pump sets. In 1973-74, there will be about 8 lakh Kms. of 11,22,33 and 66 KV feeder lines, which are the real base to cater to the needs of the rural areas. It would be economical to extend suitable spur lines from these lines to cover the villages within easy reach. A rough programme of the targets and the correspondng costs in the 7 years plan period has been worked out as required. As already indicated, larger and larger programmes could be executed with ease in future plan periods as the H.T. lines laid during prior plans would facilitate further extension.

2.5 Funds for Load growth :

2.5.1 In estimating the total financial outlay in any plan period, provisions should be made not only for the new villages to be connected up and the new pump sets to be energised but also for load growth in the localities which have already been and for the pumpset installations which have already been energised. An annual expenditure of 5% of the cost of electrification of a new village for the developed villages (*i.e.* the areas which have been using electricity for about 10 years) and about 10% in the case of localities which have only been connected up recently may be provided for as far as the development of power loads in the villages is concerned. For the irrigation pumpsets, a nominal provision of about 1% of the cost of a new pump set annually would suffice for possible increase in the capacity of the pumpsets. By and large there are not likely to be any violent changes in these services.

2.6 Cost of village Electrification :

2.6.1 The cost of electrification of a village varies widely from State to State depending on the development, the extent of the grid mains coverage etc. For a National Plan or a wide coverage average the cost may be about Rs. 30,000 to Rs. 40,000 as per detail below especially when there is a separate programme of electrification of very large number of pump-sets for irrigation.

	Rs.
1 KM of HTline	7,000
1 KM of LTlines single phase and 3 phase	10,000
A transformerstation of 50 KVA .	8,000
Service connection and miscellaneous .	5,000
TOTAL	30,000

2.6.2 For villages which are a little further away from the H.T. mains additional length H.T. mains may have to be allowed for, other parts remaining the same. For such villages a rate of Rs. 40,000 may be assumed. The cost which has been estimated at current prices may go down somewhat when considerable development has taken place but this slight decrease would be off set more or less by the increase in the cost of materials, labour etc. which may be expected.

(ii) For electrification of an irrigation pump-set, a rate of Rs. 4,000 may be taken on an average which will cover the necessary 11 KV lines, the transformer station and the L.T. lines.

(iii) For catering to load growth for normal development in villages electrified about 10 years before, per plan.	Rs.	8000
(iv) For catering to load growth for normal development in villages electrified less than 10 years before per plan.	Rs.	15000
(v) For catering to load growth in irrigation per pumpset per plan.	Rs.	200

Based on the above assumption the total cost during the 7 years Plan period will be approximately Rs. 1850 crores (vide details in Table I a.

The broad break-up for the 7 years perspective plan is as under Electrification of new villages :	Rs. 460 crores
Electrification of new pump sets	Rs. 1125 crores
Load Development.	Rs. 265 crores

2.7 Consumers Credit and Raw Materials Requirements :

2.7.1 It is to be emphasised that rural electrification by no means should be considered in isolation and is essentially a part and parcel of the general power development programme. The actual pace of rural electrification will, therefore, be largely determined by and dependent upon the general pace of development in the power sector in the country. Besides, for enjoying the fruits of rural electrification, a consumer would be required to make an investment of almost an equal amount for his own installation. It would therefore, be necessary to find and ensure flow of the required amount of credit to the perspective consumers, besides financing the rural electrification programme themselves. For the present, the main hurdle in the country in carrying out the rural electrification schemes seems to be, besides, the shortage of power, the shortage of essential materials, like transformers, aluminium, steel etc. The undertaking of a massive rural electrification programme at an accelerated pace must, therefore, have to be preceded also by proper perspective planning of the material resources.

TABLE—1a

Rough Estimates on cost of Rural Electrification During 1973-84.

	End 1968-69	During IV Plan 1969-74	During 7 years plan 1974-81
	1	2	3
Villages electrified .	70,000	50,000	1,40,000
Pumpsets energised .	11,00,000	15,00,000	28,11,000

Rough Estimates (Rs. in crores)

(a) Village@ 30,000	70%		
40,000	30%		460
(b) Pumpsets@4,000	24,00,000 Dugwells 4,00,000 Private tubewells 11,000 State tubewells		1,124
(c) Load Growth 8,000 per Plan			780
(d) Load Growth@ 15,000 per Plan			126
(e) @200 per plan per pump set			72
		Total	1,852

Say Rs. 1,850 crores.

Contd.

CHAPTER III

UNDER-GROUND WATER RESOURCES IN INDIA

3.1 After the meeting of the National Development Council in September, 1965, the emphasis in rural electrification has been shifted to electrification of agricultural pumping sets. It is envisaged that during the Fourth Plan about 15 lakh pump sets will be electrified. The electrification of pump sets is linked with the availability of ground-water in the area. All the wells drawn upon sub-surface water, shallow or deep, depending on the nature and formation of water bearing strata. In the alluvial plains of the Punjab and Uttar Pradesh, water bearing strata are easily available but in the peninsular plateau such strata are limited because of rocky sub-surface formations. It is, therefore necessary that before a scheme for electrification of tube-wells is sanctioned, a check for the availability of underground water should be made. This information can be obtained from the respective Regional Directorates of Geology which are situated in almost all the regions.

3.2.1 Status of ground-water studies, potentialities and development in various areas:

Regional geophydrological investigations involving primarily the study of occurrence, form and slope of the water table in the country in relation to different geological conditions were carried out with a view to determining the ground water resources. These field studies were subdivided area-wise in the following categories to facilitate the proper appraisal of the prevailing ground-water conditions:

1. Alluvial tracts/River basins of valleys.
2. Areas underlain by semi-consolidated rocks.
3. Areas covered by wind-blown sands.
4. Consolidated or hard rock areas.
5. Coastal tracts.
6. Submountain valleys.
7. Waterlogged areas.
8. Large industrial and mining areas.
9. Saline tracts and thermal springs.

3.2.2 In the alluvial areas, it is estimated that a pump set can work for about 800 to 2000 hours during a year whereas in the hardrock areas the working time reduces from 300 to 600 hours a year. To ensure that there is no shortage of groundwater in the areas where the schemes have been formulated, it is desirable that the survey of ground-water resources is conducted in the potential scheme areas and data in this respect kept ready by the State Electricity Boards. This work could, perhaps, be carried out by the State Departments of Agriculture or the Groundwater Organisation in the State. If necessary, assistance could also be obtained from the Geological Survey of India and the Exploratory Tube-well Organisation of the Union Ministry of Agriculture.

3.3 Quantity of water available in different areas and total quantity being used:

3.3.1 The existing knowledge about the groundwater resources about different parts in the country is by no means complete. Quantitative assessment of ground-water has been carried out only in some areas. A map showing the groundwater possibilities in India is enclosed at Annexure-V. On the basis of the average annual rainfall of 114 cm. over the entire country, it has been estimated in recent years that about 800×10^{9} cubic metres (651 million acre feet) of water seeps down annually into the soil. Out of this, about 430×10^{9} cubic metres (35000 million acre ft.) of water is retained as moisture in the top soil, that supports vegetation. The remaining 370×10^{9} cubic metres (301 million acre ft.) of water percolates down into the subsurface to replenish groundwater reserves. When estimated down to a depth of 305 metres, the total storage of groundwater in India works out to a figure of $37{,}000 \times 10^9$ cubic metres (30,100 million acre ft.) or ten times the annual rainfall in the country. It is estimated that the present annual utilisation of ground-water is about 22×10^9 cubic metres (17.1 million acre ft.) which indicates that by and large, an enormous quantity of the groundwater reserves still remains unexploited.

3.4 Quality of ground-water in various areas :

3.4.1 It is generally recognised that not only the quantity of groundwater available from an area but also its quality is of major importance. The quality should, therefore, be checked before the ground-water is used for irrigation to see whether it meets the requirements of irrigation water.

3.4.2 All ground-water carries some salts in solution, derived from the solution of rock materials during weathering and erosion. There is little contribution of salt to ground-water from igneous rocks but sedimentary rocks having more soluble constituents may add substantial amounts of dissolved salts to the ground-water. Localised concentrations of salts may result from intrusion by sea water, thermal springs, brine and also from fertilizers. Stagnation of ground-water, resulting from its movement through less permeable formation, may also add to the increase in salt content. It is essential that the test for salinity of ground-water should be made before it is used for irrigation purposes. This should be done before the connection for electrification of tubewell is given. In Punjab, the salinity of groundwater in old canal irrigated areas has been causing serious problems. For the purpose of limiting salinity in groundwater in canal irrigated areas, it is necessary to locate tubewells on either banks and integrate the flow irrigation with groundwater sources also and this practice is being increasingly found to be economical and beneficial in the alluvial regions.

3.5 Augmentation of ground-water resources :

3.5.1 Unlike other mineral resources, ground-water gets replenished by natural processes, and if our scientific knowledge enable us to maintain a balance between utilisation and replenishment, a perennial supply can be assured. The rainfall data of the area under study as also of the catchment or recharge area should be collected. These data, upon analysis, will enable the estimation of normal seasonal rainfall, its frequency, intensity, extent and sequence of periods of flood or drought. These characteristics help in estimating the replenishment of various water sources. Similarly, measurements of stream discharges are very important in areas where ground water supplies receive their major replenishment by percolation from stream flow.

3.5.2 With the electrification of tube-wells, the quantity of water pumped out of the subsurface is increased considerably. Recharge of ground water could therefore be more and more important as the number of electrified tube-wells increases. In any groundwater basin, the natural ground water storage can be augmented by methods of artificial recharge. Artificial recharge is defined by Todd as the augmenting of natural infiltration or precipitation of surface water into underground formation by some methods of construction, spreading of water, or by artificially changing natural conditions. The selection of a suitable recharging method depends upon local topography, geological and soil conditions, quantity of water to be recharged and its ultimate use. Climate, land value and the quality of water may, under special conditions, play an important role in the choice of the method.

3.6 Co-operative use of tube-wells :

3.6.1 Co-operative use of tube-wells should be encouraged. This means that a group of farmers would join together and avail of the water on a co-operative basis. This would help in pooling up the resources for taking tubewell connections. In other words, it would mean that the farmers with small holdings would join together and approach the Government for electrification of tube-wells, from which all of them would benefit. It is understood that this practice is obtaining in East Pakistan. Selling of water pumped by tube-wells should also be encouraged. The tariff for this water should be fixed by Panchayats. Cooperative use of tube-wells or selling of tube-well water would help considerably in increasing the load factor and would improve the economics of rural electrification.

CHAPTER NO. IV

FINANCING

4.1.1 Out of a total outlay of Rs. 417 crores earmarked central assistance was provided by the Government of India for rural electrification schemes upto 1968-69. The year-wise assistance provided is given below :

	(Rs. in lakhs)
1st Plan	827.52
2nd Plan	822.17
3rd Plan	8628.38
1966-67	6211.63
1967-68	1579.94
1968-69	4287.00
TOTAL	25416.64

4.1.2 Since the beginning of the Fourth Plan no earmarked Central assistance is provided for rural electrification schemes and the expenditure on such schemes is incurred by State Governments from the State Plans inclusive of overall Central assistance provided to the State Governments.

4.1.3 In the Fourth Five Year Plan, outlays in the State plans are expected to be of the order of Rs. 285 crores and in the plans of the Union Territories of the order of Rs. 9.5 crores (outlay for rural electrification and targets of onergization of additional pump sets Statewise in the Fourth Five Year Plan are given in Annexure VI). These outlays will enable energisation of about 7.5 lakhs additional pumpsets and the incidental electrification of about 25000 villages. In addition to the above amount of Rs. 294.5 crores, Rs. 150.0 crores will be made available by the Rural Electrification Corporation.

4.2 Rural Electrification Corporation.

4.2.1 During the Fourth Plan the Central Government will contribute Rs. 45 crores to the Corporation, and U.S. Aid will contribute Rs. 105 crores from U.S.—Use Funds. The capital contribution to the Rural Electrification Corporation during Fourth Plan will, therefore amount to a total of Rs. 150 crores. It is expected that with the resources available from the Corporation, an additional number of 5 lakhs pumpsets would be energised during the Fourth Plan. After taking into account the outlays indicated in the Fourth Plan for State Governments, Union Territories and also the additional resources which can be mobilised by State Electricity Boards, the additional number of pumpsets expected to be energised during the Fourth Plan would be about 15 lakhs. The energisation of 15 lakh pumpsets during the Fourth Plan is expected to provide irrigation facilities to an area of about 8 million acres and add not less than 4 million tonnes of food grain production. Every possible effort should be made by the concerned Boards to raise maximum resources for the task as it is chiefly the prosperity of the villages that the economic development and prosperity of the country will be achieved. The main objectives of this Corporation are to finance rural electrification schemes in the country, subscribe to special rural electrification bonds that may be issued by the State Electricity Boards and to promote and finance rural electricity co-operatives in the country. The Corporation will sanction schemes which meet the test of economic viability and which have been framed at a project basis so that the extension of electricity alongwith other investments and in-puts results in increased agricultural production and reasonable returns on agricultural investment. In economically backward areas with future agriculture potential the requirements of a proper return on investments has been waived for a short initial period not exceeding 5 years.

4.2.2 The Corporation has finalised its terms and conditions for financing the rural electrification schemes in the country. These are briefly as follows:—

I. For Schemes relating to backward areas :

(a) *Minimum return.*—½% within 5 years, 2% within 10 years, and 3½ within 15 years.

(b) *Terms of repayment :*

(i) Interest.—5¼% per annum for the first 10 years, 5¾% for the next 5 years and 6¼% thereafter with a rebate of ¼% for prompt payment.

(ii) *Period of moratorium*—5 years.

(iii) *Remaining period of loan*—25 years.

(c) *Mode of Payment :* Payment of interest only during the first 5 years and equated annual instalments (inclusive of principal and interest) in 25 years thereafter.

II. *For Schemes relating to other areas :*

(a) *Minimum return.*—2% within 5 years project and 3½% within 10 years.

(b) *Terms of repayments :*

(i) Interest.—6¼% with a rebate of ¼% for prompt payment.

(ii) Period of moratorium—5 years.

(iii) Remaining period of loan—15 years.

(c) *Mode of Repayment.*—Payment of interest only during the first 5 years and repayment of principal and interest on the basis of equated annual instalments in 15 years thereafter.

Form of Security for both the Categories :

Full and unconditional guarantee by the State Govt. in favour of the Corporation in respect of payment of interest and repayment of principal.

4.3 Assistance Provided by Financial Institutions to State Electricity Boards for Rural Electrification

4.3.1 A brief survey of the financial position and problems of the State Electricity Boards shows that inadequacy of funds has been hampering their effort for rural electrification. There is a strong case for giving them financial assistance on specially liberal terms if this programme is to be promoted and intensified. So far not much assistance of this type has been actually made available. The desirability of working out a suitable pattern of financial assistance to the Boards for the rural electrification programme can hardly be overstressed. In this connection it may be stated that in foreign countries, subsidy has been given for rural electrification in one form or the other. Arguing that rural electrification is not remunerative, at least in the initial stages, the State Electricity Boards which are the authorised agencies for the execution of this programme, have emphasised the need of financial assistance in one form or the other. The parallelism has been cited in assistance for rural electrification provided in foreign countries, such as Belgium, France, Italy, Switzerland and Canada, where subsidy has been given though at varying rates and basis as shown below :

Country	*Subsidiy rate*
1. Belgium .	30 per cent of cost of work.
2. France .	30 to 40 per cent of the total cost of extending the net work and increasing its capacity.
3. Italy .	50 to 60 per cent according to purposes for which supplies were sanctioned.
4. Switzerland	20 to 25 per cent of cost of over head lines.
5. Canada .	50 per cent of the capital cost of high voltage lines.

In the U.S.A. long-term loans at low interest (2% per annum) repayable over a maximum period of 35 years are given. Financial assistance can take various forms ranging from outright grant-in-aid or subsidy to interest-free loans on long-term loans at reduced rates of interest.

4.3.2 The institutional finance from financial institutions available today to the Electricity Boards for financing their rural electrification programmes comprises loans provided by the Land Development Banks/Agricultural Re-Finance Corporation, the Commercial Banks/Agricultural Finance Corporation Ltd. and the Life Insurance Corporation of India. The extent of the institutional finance expected to be available to the Electricity Boards during the 4th Plan period has been broadly estimated at about Rs. 75 crores by the Working Group on Power. A broad picture of the framework of assistance extended by these financial institution is briefly discussed below.

4.4 Financial assistance by Land Development Banks/Agricultural Refinance Corporation.

4.4.1 In the context of mounting strain on the resources available for outlays on rural electrification, some of the Electricity Boards for some time past had been raising funds from the beneficiary cultivators through deposits which in quantum represented either whole or a substantial part of the estimated cost of connection. These deposits are either returned with interest or adjusted against the bills of the consumers. Against this background and recognising the fact that the energisation of the pumpsets financed by the Land Development Banks under their special development schemes with refinance facilities from the A.R.C. might be held up if the deposit money was not readily available to the cultivator, the A.R.C. agreed to provide refinance in respect of loans of Land Development Banks to individual farmers including a portion of the cost of electric lines upto Rs. 3000/- per well; subject to this being within the cultivator's repaying capacity. In extending such refinance facility the Corporation has agreed that deposits need not necessarily be restricted to the cost of Low Tension lines but might include where necessary, even the High Tension lines. It is, however, made a condition that the amount of loan sanctioned to farmers for payment of deposits to the Electricity Board will not be disbursed to the farmer but on the other hand will be paid to the Electricity Board direct by the Bank on behalf and under authorisation by the loanee farmers. The other terms and conditions attached to the Electricity Deposit loans are as follows :

(1) Any payment by the Electricity Board by way of interest and instalment of deposit will be made direct to the Central/Primary Land Mortgage Bank which will make the necessary entries in the farmer's loan account.

(2) The Electricity Board will agree to pay to the farmer interest at a rate not less than 6% on the amount deposited with it by or on behalf of the farmer. The Electricity Board will also agree to refund to the farmer or to the Central/Primary Land Mortgage Bank on behalf of the farmer in annual instalments the full amount of deposit within a period not exceeding the period for which the loan has been sanctioned by the Central/Primary Land Mortgage Bank to the farmer.

(3) The State Government will guarantee that the money so made over to the Electricity Board will not be allowed to be appropriated by the Board for purposes other than the installations specifically required for electrification of the wells in the scheme.

(4) The State Government will also provide guarantee to the Agricultureal Refinance Corporation to the effect that if the Electricity Board does not completely instal the line and energise the pumpsets in the scheme area effectively within a period of one year from the date of payment of the deposit, the State Government will repay the amount of deposit together with interest at a rate not below 6% per annum to the A.R.C. thereby discharging the liability of the Landing Bank and the farmer respectively in respect of that portion of the loan. On payment of this amount the Central Land Mortgage Bank will be permitted to treat the Special Development Debentures of an equivalent amount issued to the Corporation as fully re-deemed on the date on which the payment is made by the State Government and would also credit the farmer's loan account with the amounts paid to the Electricity Board as deposit.

4.2.2 With a view to ensuring the smooth working of the scheme the State Government is also advised to adopt certain precautions in certain given circumstances. For instance, where the repayment by the Electricity Board to the farmer on account of interest and refund of deposit is to be adjusted against Elecricity bills payable by him, as no revenue will accrue to the Electricity Board on the electrification work extended to the scheme area till the amount was fully refunded, it is stipulated that the State Government should, if so required by the Board, make adequate provisions regularly on the revenue side of their budget and annual plans to compensate the Board the loss of revenue on these lines.

4.5 Financial assistance by Commercial Banks/Agricultural Finance Corporation Limited :

4.5.1 With the introduction of Social Control Policy in particular, the Commercial Banks started financing Electricity Boards for their rural electrification programmes in a substantial way.

The financial assistance so provided by commercial banks to State Electricity Boards comprises loans to the various Electricity Boards by individual commercial banks directly and loans provided to Electricity Board by banks in collaboration with the Agricultural Finance Corporation Limited which in fact is a consortium of member-banks. Where the Commercial Banks have directly financed the Electricity Boards and in particular, in the initial stages the quantum of such loans have been generally determined on the basis of average cost of energisation as estimated by the respective State Electricity Board and, no attempt had been made to link this loan amount to the actual cost incurred by the Electricity Boards for the energisation programme for which financial assistance is sought from the banks. The terms and conditions as regards rate of interest, period of loan etc. varied from bank to bank. Illustratively, the terms and conditions stipulated in the case of a loan which one of the Banks (now a nationalised Bank) has given to one of the Eelectricity Boards are given below :

(i) The loan will be drawn in quarterly instalments after submitting quarterly performance reports.

(ii) The loan will carry interest @ 9% per annum on the amount drawn from time to time with half-yearly rest with a rebate of ½% for regular payment of interest and repayment of principal amount of loan.

(iii) The principal amount drawn in instalments will be repaid within a period of 10 years from the date of drawal of the instalment by 8 annual instalments the first of such instalment to commence after the expiry of 3 years from the date of the drawal of instalment and the subsequent instalments on the expiry of each and every subsequent year thereafter and the quantum of each annual instalment shall be as under :

First being 5% of the principal sum lent & advanced.

Second	5%	do
Third	10%	do
Fourth	15%	do
Fifth	20%	do
Sixth	20%	do
Seventh	15%	do
Eighth	10%	do

(iv) The repayment of principal amount, payment of interest and all cost charges and expenses should be guaranteed by the State Government.

(v) The State Electricity Board will implement the various suggestions which may be mutually agreed upon by and between the Electricity Board and the Bank for making the scheme economically viable.

4.5.2 With the entry of Agricultural Finance Corporation limited into the field of providing assistance to Electricity Boards, a greater degree of rationalisation of procedures to fall in line with the terms and conditions of loans sanctioned by Agricultural Finance Limited itself has taken place. Accordingly, at present even where individual Commercial Banks (now for the major part, the nationalised banks) extend financial assistance to State Electricity Boards, it is understood that the terms and conditions of the loan are more or less on par with those which are financed by Agricultural Corporation Limited.

4.5.3 The scheme of financial assistance evolved by the Agricultural Finance Corporation Limited envisages disbursement of loans to the Electricity Boards against approved schemes on a reimbursement basis after the scrutiny of the quarterly performance report of Electricity Boards. The Agricultural Finance Corporation has adopted this procedure with a view to ensuring that—

(a) the Electricity Boards do not divert the funds for other purposes; and

(b) that the farmers actually get the power supply for their wells as envisaged in the programme.

The criteria for assistance broadly adopted by the Agricultural Finance Corporation are as follows:—

(1) The finances to be made available by the Corporation to the Electricity Boards should supplement their resources ear-marked for the purpose in their annual plans and budget or in other words the actual number of wells to be energised by the resources to be made available by the Corporation should be over and above the number of wells

which would normally be energised under the Plan and the normal programme of the Electricity Boards.

(2) The Corporation's finances will be limited to the commercially viable part of the programme viz. the transformer centres, LT supply lines, service connections and a reasonable length of 11 KV lines.

(3) The Corporation's loans will be made on a project basis and will be subject to the scheme being remunerative, i.e. the annual revenues from the scheme should be sufficient enough to meet the annual cost and leave enough surplus to be utilised for payment of interest and repayment of loan.

4.5.4 The loans generally carry interest at $8\frac{1}{2}\%$ per annum with $\frac{1}{2}\%$ rebate on regular payment. The A.F.C. also levies a service charge at $\frac{1}{4}\%$ on the total amount withdrawn by the Electricity Board. There is also a commitment charge levied at 1% in the event of default to withdraw the loan amount within a specified date. The repayment of the loan is to be made upon the expiry of 5 years generally. The A.F.C. also insists on State Government guarantee for repayment of principal and payment of interest. It is also made a condition that the State Electricity Boards shall comply with such suggestions and directions as the Corporation may give in regard to the implementation of the scheme.

4.6 Financial assistance by Life Insurance Corporation :

4.6.1 The Electricity Boards for some time now have been borrowing substantially from the Life Insurance Corporation. Total loans issued to Electricity Boards by the LIC, as on 31-3-70 stood at Rs. 13346.00 lakhs (This was in addition to its subscription to the Electricity Boards Bond at Rs. 4947.99 lakhs. The exact nature of assistance provided by the Life Insurance Corporation is not readily available but it is understood that the L.I.C. unlike the A.R.C. or the A.F.C. does not follow a project approach. These loans are provided against a mortgage of the Board's assets. It is also understood that the loan carry an interest of 7.25%.

FINANCIAL ASSISTANCE BY STATE GOVERNMENTS

4.6.2 One of the recommendations of the Report of the Committee on the working of the State Electricity Boards headed by Shri R. Venkataraman is "to facilitate intensive rural electrification, the Committee recommends that the possibility of getting loans interest free for the first five years may be explored. The State Electricity Boards would welcome funds to finance these schemes on easy terms of payments of interest over a long period. Some State Governments have already made provisions as given below :

(1) Maharashtra Government charges interest on loans advanced for rural electrification at reduced rates of one per cent for the first year, two per cent for the second year, three per cent for the third year, four per cent for the fourth year, five per cent for the fifth year and six per cent for the sixth year.

(2) Andhra Pradesh and Madras Governments have made a provision that whatever village is electrified, the gram panchayat of that village should compulsorily include harijan wada (harijan colony) for electrification, the expenditure for the purpose up to 15% being met from funds earmarked for the benefit of the Scheduled Classes.

4.6.3 The Power Economy Committee recommend that such provisions should be made by other State Government also for encouraging rural electrification in the country.

4.7 Rural Electric co-operatives.

4.7.1 The Rural Electrification, in USA could spread rapidly and cover the entire country because it took the shape of a people's movement. Essentially, in this sub-continent of India, where 80% of its population live in the villages, it has to grow, in the same manner, as a people's movement. As a matter of fact, electrification of each village is so much involved and the administrative and local problem could be so numerous that unless the people of the villages give their full co-operation, it might be a very time-taking task for the Government to spread rural electrification as a viable and efficient unit in the far and widely scattered villages of the country. For this purpose and in the existing constitutional set up of the country, which has democratic socialism as its objective, the Committee felt that the rural electric co-operatives should give a suitable solution to the problem of 'total' electrification of the country in an efficient and economic manner. The All-India Rural Credit Review Committee has also recommended that while it was most essential that electricity supply should be made available to the farmers, cultivators and small enterprise owners to the largest extent possible for their pumpsets or other agricultural uses as also for small industries, there was a fear that in the present state of finance of the State Electricity Boards which are none too good, there could be a danger that rural electrification might fail to get its due place in the power development programmes of the States, unless large additional resources can be made available for this purpose. Therefore, the Government of India decided to from a Rural Electrification corporation and with this objective in view, it was necessary to develop as fast as possible, the rural electric co-operative, the financing of which should be done by the rural electrification exclusively. As pilot projects the Government has already set up five rural electric co-operatives one each in the States of Andhra Pradesh, Gujarat, Maharashtra, Mysore and U.P. The co-operative societies have already been formed and registered. These five rural co-operatives will be financed by the Rural Electrification Corporation. The purpose of introducting pilot co-operatives is to achieve the following:—

(a) Furnish electricity to the rural people at a reasonable cost in order to increase agricultural production; stimulate small agro-industry; and improve the standard of living for the rural population.

(b) Increase responsible action of the people by giving them some degree of control of their electricity supply.

(c) Establish local organisations for the financing, procurement, installation, repair and proper use of electrical appliances and equipment such as pumpsets.

(d) Provide the basis for a rapid and standardised pattern of construction and operation for rural electric systems in all States of the Union.

(e) Provide meaningful training experience for Indian personnel involved in rural electric co-operative activities so that they can help other such cooperatives.

4.7.2 The co-operatives will enthuse the spirit of ownership in the villages and thus, help to avoid damages to the electrical installations and theft of energy. This would also facilitate the co-operative use of pumping sets, electric appliances such as threshing machines, drying facilities for fruit, cold storage facilities, etc. There are many advantages in the Cooperative use of certain electric appliances. Firstly, there is the economic view of the customer. Purchase of such appliances by individual farmers may not be possible especially in areas with an unsatisfactory agricultural production. The appliances would be too expensive and their insufficient utilisation may not, because of the high cost, increase profitability of the farm. In the co-operative method, the poor farmer can take full advantage of electricity for his work. Further, if individually owned, the electrical appliances are often simultaneously used which results in high peak loads and low load factors. Thus, high loads can be avoided if the individual loads arise after one another and thus, the consumption of electricity is more steady and results in improvement of the load factor. In this connection, the example of South Germany where the agricultural conditions are not as promising as in other parts of Germany, may be cited. There, the electric implements are co-operatively purchased and used. The villagers often set up special co-operative houses into which all necessary implements are installed. The use of these appliances is then made on a suitable timetable and this small disadvantage is more than compensated by all the amenities and advantages which the use of electric energy produces. The electric utilities make a good contribution in this by often providing appliances on instalment basis.

4.7.3 Rural electrification can also be promoted by establishing electrified farms. These farms will set an example to the farmers as to how the power could be utilised to better their lot and to improve their revenues. These farms will also serve the purpose of supplying necessary data to the electric utilities as to how the consumption of farms can be increased and as to how the load factor can be improved.

4.7.4 For the money borrowed from R.E.C., the borrowing Society shall pay interest on the loan at 4¼% per annum during the period of moratorium viz. 5 years from the commencement of the project, plus the first 5 years thereafter i.e. for a total period of 10 years from the commencement of the project $5\frac{1}{4}\%$ per annum for 5 years thereafter, $5\frac{3}{4}\%$ the next 5 years and $6\frac{1}{4}\%$ for the remaining period, with a rebate of $\frac{1}{4}\%$ at all stages for punctual repayment of instalments of principal and interest, provided that the Corporation will be prepared to forego the interest for the first 5 years on the Society agreeing to set apart an amount equivalent to the interest at prescribed rate for a special fund to be constituted and administered in accordance with the rules which will be framed by the Society with the approval of the Corporation. The interest shall be payable on half-yearly basis and shall become due on 1st October and 1st April every year. The period of moratorium for payment of principal shall be 5 years from the commencement of the project but the entire loan shall be repaid by the Society within the period of 35 years from the date of commencement of the project. The Society shall, however, pay or credit interest as indicated above during the period of moratorium. The repayment of principal and interest shall thereafter be effected on the basis of equated annual instalments in 30 years commencing from the close of the fifth year.

4.7.5 From the foregoing paras it would be seen that financing of rural electrification is being done at present principally by State Govts., AFC and Commercial Banks (market loans from Commercial Banks). The terms and conditions for financing authorities are different. Apart from the fact that this adds to the work of State Electricity Boards the criteria for viability is also varying. While the Committee feels that the most important objective is to provide sufficient finance for the RE works for the magnitude of the task which has been explained in the foregoing paras, it was generally felt it might be useful for the financial agencies to fall in line with a rationalised and uniform basis and formulate rationalised and uniform terms and conditions and uniform criteria for determining the viability of schemes.

4.8 Integration of Rural Electrification with area Development Schemes and Rural Industries etc.

4.8.1 Of the various recommendations made by the All-India Rural Credit Review Committee, the important ones relating to rural development are establishment of strong and viable co-operative unions at the primary level for successful implementation of the agricultural programmes. Similarly, various ways and means have been enunciated by this Committee for the smooth flow of credit facilities in the rural areas to farmers. Similar arrangements for medium-term loans and short-term loans for investment by farmers and small-scale industries are already existing in the rural areas. Lead banks at district level have been established throughout the country and commercial banks are making special efforts in this direction. The Reserve Bank of India and these nationalised banks are playing very dynamic role in providing necessary rural credit for intensifying the different activities of agricultural and small-scale industries. Further more, the Agricultural Finance Cooperative nationalised banks, cooperative banks, land mortgage banks, land development banks, etc. have similarly very much accelerated the developmental activities in the rural sector in agricultural production and investment and are covering all the different aspects of economic growth by accelerated flow of credit to rural areas. The State Governments, on the recommendations of the Government of India and Planning Commission, are taking urgent measures to step up agriculture and rural industries and for this purpose the State Governments formulated development package programmes, pilot development programmes, area development schemes, special assistance programmes to tribal areas, etc. In this context it is felt that in order to accelerate the development of rural areas, the easiest and the quickest way would be to integrate rural electrification programmes with the programme of agricultural and other rural industrial development schemes. This question also came up for consideration in a meeting held by the Planning Commission in July, 1970. Two suggestions that emerged were : (a) setting up of a co-ordination Committee at the level of the State Electricity Boards; and (b) similar committees at the district levels. The committee at the Electricity Board level should help the boards in formulating the new schemes of rural electrification with reference to the potential demand for power for agriculture as well as small industries, it could review the progress of implementation of approved schemes, suggest measures for better utilisation of the load and devise ways and means of encouraging the entrepreneurs to deve lop small industries by taking advantage of the availability of electricity in rural areas. Similarly, the committees at the district level could assist the board in carrying out a field survey to assess the potential demand for power in the selected areas and in securing better utilisation of power by carrying out the implementation of sanctioned rural electrification schemes with the programme for growth of small industries and development of agriculture. As regards the composition of the committees, it has been suggested that the committee at the State level may consist of the Chairman of the Electricity Board as Chairman and the State Directors of Agriculture and Industries and the Managing Director of the State Cooperative Land Mortgage Bank as members. The State Government may consider appointing other members. The committee at the district level may have the collector of the District as Chairman and the district level officers in charge of agriculture and industries and the Executive Engineer of the State Electricity Board as members. The two committees may co-opt additional members as may be necessary. In deciding the composition of the committees the local circumstances and the pattern of development administration obtaining in the State may be kept in view.

4.8.2 He would recommend that the above suggestions of the Planning Commission and the Rural Electrification co-operation should be implemented by the States. The above two committees will be able to provide the necessary data to the State Electricity Board in respect of all matters connected with rural electrification and this would facilitate selection and implementation of the schemes in the best overall interest.

4.9 **Balanced Regional Development—Preference to Backward and Tribal Areas :**

4.9.1 Regional differences between better developed taken into account areas do not seem to be taken into account while preparing project reports in some States. The selection of rural areas for electrification is mainly done on the basis of financial yardsticks, nearness to electrical installations including H.T. and feeder lines, population, accessibility and such other factors. In some States preference used to be given for electrification of backward areas. Some years back the composite State of Punjab laid down a policy to give preference to the hilly and backward districts in the matter of rural electrification. Separate funds were earmarked and a number of projects were sanctioned for extension of electricity to backward districts like Mohindergarh, Hissar, Kangra, Sangrur etc. In Mysore, preference in rural electrification has been given to backward districts (Malnad areas) for which a lower level of gross revenue return was specified. In a few other States like Andhra Pradesh, Bihar, Maharashtra and Uttar Pradesh where although the financial policy and yardstick of returns show no differentiation between forward and backward regions for rural electrification, some preferential treatment is accorded to backward or hilly areas in the actual execution of the programme. For example, in Andhra Pradesh a definite proporation of the budget allocation is reserved under the system of priorities for electrification of backward districts.

4.9.2 The order of priority followed in the selection of villages for rural electrification in different States does not seem to indicate that it has been spelled out fully. Broadly speaking, remunerativeness, nearness to main transmission lines, population and accessibility have been the guiding criteria. Due consideration should be given for electrification rogrammes in backward/ tribal areas. Also to the extent possible rural electrification should be taken up in a concentrated form in compact blocks of area with considerable agricultural or other potential as such a programme will lead to an integrated area development and yield richer dividend in the future.

CHAPTER V

ECONOMY IN DESIGNS OF LINES AND SUB-STATIONS :

5.1.1 Rural Electrification prior to independence, was practically insignificant in this country. After Independence, a few rural localities, i.e. densely populated localities and large villages, in a limited number of States, were electrified. Electrification continued to be on a highly selective basis, as was necessary for urban electrification programme. Practically, upto 1960s the position continued to be the same except in a very few States where either there was a demand for electrification from the enlightened and progressive rural population or to such of the areas like the Southern States of India or Punjab, Bombay and U.P. where cheap hydro power was available in abundance and market had to be found for selling this power. During this period, rural electrification construction was more or less developed on urban type of construction and, therefore, this was expensive. Gradually as the demand for rural electrification grew up and it was demanded by more an more people in wider areas, the need for reducing the cost of construction for the rural electrification schemes became more and more imperative CW&PC and some of the State Electricity Boards did develop a certain amount of standardisation in designs of rural power lines and sub-stations but still there is a very large scope for achieving economy by standardised designs manufacture and construction practices in the field of rural electrification.

5.1.2 The rural electrification programme started gaining momentum since the beginning of 1960 and assumed a national importance after the country suffered from continued droughts in 1965-67 consecutively for three years. Simultaneously, the agricultural sector had made revolutionary progress and developed new scientific methods of multiple cropping, improved seeds, higher productivity, etc., which led to the 'green' revolution in several areas in the country. By this time the farmers were not prejudicial to the introduction of modern scientific methods and there was a very large demand for supply of water, fertilizer, improved seeds, pesticides, etc. for increasing the agricultural production which is now being demanded urgently on a national scale.

5.1.3 Government Departments State Electricity Boards, Planning Commission and other organisations in-charge of agriculture and rural electrification recognised that the objectives of electrification programme are to make new approach in order to remove or modify substantial barriers that had impeded the progress in the past. It was realised that comprehensive and intensive development of earmarked areas was needed. To achieve this objective, it was necessary that the cost of construction be reduced and more favourable terms and conditions for rural electrification made available to farmers, besides making rural credit available for financing the farmers willing to embark upon this programme of higher agricultural productivity. On the one hand, the area development approach assures availability of electricity to all farmers in compact areas for meeting their irrigation needs, and one the other hand, the mass production and standardisation in rural electrification works could easily result in substantially lower cost of electrification so as to make electricity available to wider areas and at the same time enable a faster execution of the programme. This substantial reduction by simplifying and standardising designs and materials and construction practices, therefore, would help on broadening the area of economy and areas of rural electrification in increasing the number of farmers using power-driven pumps, etc. and bringing reduction in the electric bills from which funds for amortization of the Government loans could be made.

5.1.4 Therefore, the need for economical designs of lines, sub-stations and materials used by simplification and standardisation of specifications and construction practices, has become a matter of great national importance for the economic upliftment of the country.

5.1.5 For economical design of rural lines and sub-stations, it is essential to begin with system planning of the electric distribution systems. It is, therefore, necessary to collect a certain amount of necessary data after detailed investigation of rural areas. Such data should preferably be on an "area development" basis for integrated and intensive development of the earmarked area where all the inputs for agricultural and industrial development will be simultaneously fed by the different departments and agencies for its economic development. This system planning should provide the management with a long range outline for the system growth as well as with the intermediate work plans on a faster programme basis.

The system planning would provide for the following :

(a) An orderly development of the system to minimise wastage through lines and sub-stations becoming inadequate early in their service life.

(b) System expansion in a manner such that new investment in facilities is in step with load growth and revenue.

(c) Maximum use of opportunities to improve quality of service.

(d) Maximum use of anticipated developments in equipment design and application.

(e) A correlation of the three main components of the system—power supply, transmission, and distribution—so as to maintain reasonable economical balance between them.

5.1.6 Basic data which are essential for system planning are as follows :

1. Up-to-date Key Map and Circuit Diagram and one set of Detail Maps showing the existing system.
2. The location of all large power and special loads.
3. Results of all recent voltage and current investigations.
4. All pertinent data relative to existing and potential sources of power, together with present and probable future wholesale power rates for both existing and potential power sources.
5. Copy of the latest operation and maintenance survey report and other records of operations.
6. Any other pertinent data which relate to the services to be performed by the the engineer.

5.1.7 There are different methods for calculating the economical designs and it is necessary that there should be some standardised procedures to facilitate selection. One method should be a simple compilation of annual cost of two or more line designs, another method may be, which is slightly more comprehensive, determination of the range of loads for each type and size of plan econmically. The important aspect of the economical line design in this country relates to the use of conductors, supports, and other materials and for the span lengths of the lines to be adopted for which alternatives could be worked out and it is necessary that the most economical designs amongst them should be adopted. Various types of materials, supports and spans have been used in different States with the result that the unit costs of identical lines and sub-stations vary widely. From the estimates obtained from REC attached to Annexure-VII, it is seen that the cost of 11 kV line for various types of supports and conductors varies from Rs. 6,325 to Rs. 13,065 per Km. The span lengths of 11 kV lines vary from 50 m. to to 150 m. under almost identical conditions. The cost of a 11/.4 kV sub-station of 100 KVA capacity varies from Rs. 8,305 to Rs. 15,685 as shown in Annexure VIII.

5.1.8 It should be possible to develop a complete range of technical literature for the guidance of State Electricity Boards for solutions in regard to economical design of lines and sub-stations standardised specifications of materials and equipment and construction practices. If the manufacturers and fabricators in the country use identical and uniform specifications, it would go a long way to reduce costs and increase availability of products for rural electrification works as these methods will help in long term and continuous planning of manufacture on a mass scale for which raw materials could be planned in advance and factories worked to full capacity. Further, it would be of great advantage to the

State Electricity Boards if the calculations, tables, charts and guide instructions in a standardised way for determination of economical design of lines and sub-stations, are prepared by a Central agency like the R.E.C. and distributed for adoption strictly by the State Electricity Boards. It will be very useful if the standard specifications of materials in detail be prepared by REC and a complete volume of the list of specifications and drawings for materials for use in the rural electrification works be furnished to each State Electricity Board for adoption. In order that these standard specifications and construction practices be kept up-to-date and technologically of high standard, it would be useful to work on them continuously and REC's Standardisation Cell should remain in continuous touch with the CW&PC, I.S.I. and other Research Organisations. For this purpose, the Government of India may consider formation of a special Technical Standard Committee exclusively for construction practices used for simplifying and standardising materials and code of construction practices used for rural electrification works. This Committee may be provided with permanent secretariat and should work in co-ordination with the CWPC, ISI, REC and other Research Organisations.

5.2 Energy Losses:

5.2.1 Energy losses in transmission and distribution system in countries like U.S.A. etc., are of the order of 8%, the lowest being Japan having 7% and Sweden having 12.45%. In India the percentage of losses varies from 10 to 25% in the various States. The reasons for the high losses in some of the States are many but the main reason appears to be uneconomical design and indiscriminate extesion of distribution lines to long distances to cater for small loads widely scattered over areas. Out of an average of 18 to 20 per cent loss of energy over the whole country, 3 to 4% will account for the high voltage transmission lines (132 kV and above) and the remaining 14 to 16 per cent in distribution lines, mostly in 11 kV and L.T. lines and distributing sub-stations.

Studies reveal that little attention has so far been focused on the optimisation of the distribution system in India. No doubt, optimisation is to a large extent, dependent on the proper load forecasts and future price levels of equipment and materials, even then it may be worthwhile in view of the large economy involved, to make comprehensive studies in respect of the distribution networks by the respective Electricity Boards with the help of computers, if necessary, so as to economise both in the capital investment as well as the operation and maintenance expenditures.

5.3 Single Phase vs. Three Phase Lines for Rural Electrification work:

5.3.1 In this country, distribution system in the rural areas consists mostly of three phase lines and three phase service to agricultural pumps. The electric motors used for agricultural purposes, pumping, handling and processing of agricultural products are practically all for three phase service. Rural industries and commercial power loads in rural areas are also mostly of three phase with three phase motors. However, some work has been done by the CBIP, CPRI, the Research and Development Wing of the Ministry of Development and Company Affairs and some of the State Electricity Boards, in the field of single phase power distribution. It is, however, well-known that a larger capital investment is required to render three-phase service. The depreciation, tax, interest and operating expenses are greater for three-phase than for single-phase service. Thus higher costs are also closely related to the capacity and facilities of length of line. However, the quality of service in the case of single-phase can be almost exactly the same as would be available from three-phase service. There is, therefore, great advantage by adopting single-phase power supply distribution in rural areas which will make rural electrification substantially economical and this can be made available to wider areas. The cost of single-phase 11 kV line using 0.04 sq. in. copper equivalent ACSR conductors comes to about Rs. 4,000 per Km. and for the same line, three-phase line using same conductor, the unit cost will be about Rs. 7,000 per Km. Thus it will be seen that the cost is nearly double and correspondingly the recurring cost doubles up and increasingly goes up in years. The conversion from single to three-phase line could be done gradually with the load growth on the basis of economical returns. In cases where the system is almost entirely single-phase and long distances are covered to run three-phase area, coverage service to applicants and the conversion expenditure is not economically justified, some additional provision for such conversion by means of enhanced revenue collection from such area could be introduced so that the needs of the applicants for three phase service could be met without any delay. In some of the advanced countries like U.S.A., Australia and U.K., the rural electrification in remote areas consists of a substantial portion of single-phase service line which is converted to three-phase service in course of time as the demand grows and there is hardly a difference in tariff either for a single-phase service or a three-phase, service.

5.3.2 In this country, this concept of single-phase distribution system has been under consideration for a number of years, but practically no progress could be made so far because of the reluctance on the par of the manufacturers to make available at economic prices single-phase motors for agricultural pumps, etc. Similarly, conversion equipment for conversion of single-phase into three-phase were also not available. It is now understood that M/S HEL have successfully developed suitable conversion equipment and these are undergoing experimental operations in the country. The advantages of single-phase distribution system are :

(i) Lower capital cost—about 30% less than the conventional system;

(ii) Simplified construction reduces material and labour of rural electrification and permits more rapid line building;

(iii) Supply interruptions are reduced because of the elimination of hazards caused by twigs, tree limbs and large birds, etc.

(iv) Reduced maintenance and operational cost which is an important feature of the system.

The limitations and problems are :

(i) The system cannot be adopted where large three-phase loads are expected in the immediate future. The system is very useful for villages with small loads especially those with a population of upto 500 and which number about 3.67 lakhs. Due to small loads, electrification of these villages with conventional methods may be highly uneconomical.

(ii) Hazard to human being and livestocks coming in contact with or in the vicinity of ground electrodes or grids provided for SWER.

(iii) The heating of the earth coming in contact with earth electrodes due to continuous flow of current.

(iv) Interference with telecommunication circuits.

(v) Protection.

(vi) Running of three-phase loads.

5.3.3 The value of the potential gradients which gives rise to touch and step voltages which can be fatal depends mainly on the potential rise of the electrode and this potential rise in turn depends on the value of the electrode resistivity and configuration of the electrodes. The required resistance can be had by adopting grounding grids even in soils of very high resistivity.

5.3.4 The electrostatically induced EMF in communication circuits by SWER is more when compared to singlephase two-wire or three-phase lines. This can be controlled by keeping suitable separation distance between the single-phase earth system and communication lines. Any way, the problem in the case of rural areas where communication lines are for and few between is not serious. Safe separation distances can be calculated and adopted. Since the density of communication lines through several parts of rural India is very low, standards laid down by Power and Telecommunication Co-ordination Committee can be easily maintained. This difficulty can, therefore, be easily overcome in adopting this system.

5.3.5 Even though the interruptions due to faults may be expected to be quite low, it is essential to provide adequate protection against conductor snapping and high resistance faults due to cracks in procelain insulaters. This can be arranged by having suitable conventional protection devices.

5.3.6 Single-phase motors are comparatively much more expensive than three-phase motors, and are at present not being manufactured in the country. Therefore, steps have to be taken to convert single-phase supply into three-phase. This is discussed further in this note.

5.3.7 Experiments on this system are being carried out. The Research Wing of the West Bengal State Electricity Board have conducted a lot of studies on the soil, resistivity in the State and this has been found to be within permissible range. They have also observed that a current of approximately 30 to 40 amperes on a 11 kV line had not created any interference on telephone lines. The Research Wing has also conducted some actual field tests of running a three-phase motor on single-phase supply by using suitable shunt capacitors. They found that a three-phase motor which is cheaper than a single-phase one of some capacity can be run from single-phase supply on 80% loading with the help of capacitors for phase conversion.

5.3.8 The Punjab State Electricity Board had created a single-phase 3.2 Km. long line for electrification of a village. They had observed that for a specific distance, there was no interference in the telephone lines when being in the proximity of a power line. These studies are stated to be in progress with a view to evolving an objective practice with reference to the distance of separation to be kept between the power and communication lines to avoid induction, etc. The Punjab State Electricity Board is also stated to be working on the design of capacitors for converting single-phase supply to three-phase supply for running three-phase.

5.3.9 The Tamil Nadu Electricity Board had put up five experimental installations with single-wire earth return and their operations have been reported to be quite satisfactory. It may also mentioned that they converted damaged three-phase transformers at departmental maintenance workshops for single-phase single-wire operation which resulted in further savings.

5.3.10 The Power Research Institute at Bangalore had also erected a short length of 4.6 kV line and single-phase motor of to 2 h.p. was used for pumping water from a well.

5.3.11 The Research and Development Organisation at Bhopal had recently arranged a demonstration of operation of three-phase motors on single-phase 400 volts supply obtained from a single-wire earth return system by using static phase convertor developed by them. Experiences gained as a result of investigations and research should be pooled together through the Agency of CBI&P.

5.3.12 Further research and investigations on this subject should be made by the Power Research Institute at Bangalore, the Research and Development Wing of the Ministry of Industrial Development and Company Affairs at Bhopal and the State Electricity Boards especially about running a three-phase motor on single-phase supply with suitable capacitors.

5.3.13 It is understood that Mysore State Electricity Board has also been carrying out experments on this matter. If the connected problems can be satisfactorily solved, this system could be used where the loads are scattered and small with obvious advantages.

Repair and Maintenance Facilities:

5.3.14 In order to make rural electrification a practicable proposition, it is essential that suitable repair and conversion facilities from single-phase to three-phase service, conversion of the smaller size transformer by larger distribution transformers, repairs of transformers and other equipment, etc. should be organised in the rural areas by the State Electricity Boards and other agencies in-charge of the rural electrification. Methods have to be developed for repairing transformers and equipment in the easy and simple manner for which standardised instructions have to be developed and issued so that it is possible for even the farmers or rural co-operatives to establish such repairing facilities of their own. The economics of such repairs have to be carefully viewed, for many times it is found that replacements prove cheaper than repaired ones because of lack of quality workmanship and testing facilities in the rural areas. The manufacturers, except a few, in this country have shown little interest in establishing after sales services in the rural areas, primarily because of low return or no return from such investments. It becomes, therefore, essential for the Governmental agencies to come to help the farmers and rural population. This is an important matter which should receive increased attention of the authorities incharge of rural electrification in this country.

5.4 **Maintenance:**

5.4.1 The reliability of power supply particularly in the remote rural areas is primarily dependent on efficient maintenance. The maintenance of the rural lines begins from the 6/33/22 kV outgoing feeders emanating from the 132 kV grid Sub-stations and beyond, which comprises the maintenance of the following:—

66/33/22 kV lines

66/33/22/11 kV Sub-stations

11 kV lines

11/0.4 kV Distributing Sub-stations.
L.T. and Service Lines and meters, pole fuses and fuse cutouts etc.

Time and again frequent complaints have been made by Members of Parliament and State Assemblies, public and consumers regarding frequent break-downs in power supply, deteriorating standards in operation and maintenance and low voltage conditions particularly in rural areas. As a matter of fact, in the 4th Conference of the Chairmen of the State Electricity Boards held in New Delhi on 27th and 28th April, 1970, The Union Minister for Irrigation and Power pointedly drew the attention of the Chairmen for urgent action for improving the power supply and low voltage conditions in rural areas. A Sub-committee was also constituted to look into this matter and to submit a report to the Ministry of Irrigation and Power, suggesting immediate measures. The Committee is now working on the subject from the various reports received from the several State Electricity Boards. It is found that break-downs in power supply are mostly on account of failures of distribution lines and sub-stations which account for 60 to 90% of the interruptions. The maintenance of the rural power lines and sub-stations, therefore, assume great importance for the purpose of ensuring continuity and security of power supply to the rural consumers. It is the responsibility of each State Electricity Board to operate and maintain the system properly not only for the sake of ensuring reliability of power supply but also to ensure proper utilisation of the large amount of capital invested on the rural electrification programme. The maintenance standards by and large, except in a few States, cannot be considered to be of adequate standard and hence there is a large scope for improvement which is absolutely essential for the future development of electricity in the rural areas. A systematic approach to the operation and maintenance problems of the rural lines will show that it is necessary to standardise the operation and maintenance practice in regard to enforcement of quality of service, continuous survey of the operation and manitenance arrangements, systematic sample surveys, physical inspection of the transmission and distribution lines, sub-stations and switching stations and their equipments. It is also necessary to make a continuous review of the existing electrical equipments and plan for their replacements according to the need and evolving technology. For all these purposes, it would be worthwhile to prepare standardised methods of plans for survey of operation and manitenance, guide for maintenance of transformers, switches, lines, guide for making current and voltage measurements line inspection reports, location of radio interference in rural power system, maintenance of oil circuit breakers, operation and maintenance records, outage records, pole maintenance and numbering plans, right of way maintenance, maintenance of sectionalising device, sub-station maintenance guide, safety programmes, guide for load current survey and maintenance of voltage levels. Experience in this country also reveals that the interruptions have been caused because of planning and design deficiencies requiring heavy maintenance or replacements shortly after the line or sub-station has been put into operation and this has to be safeguarded. Poor quality of materials like insulators, structures, conductors, switches, lightning arresters and circuit breakers, defective and loose joints, loose clamps, bad jumpering, defective earthing etc., are also causing a large number of interruption and require heavy maintenance. Over-loading, mal-operation, human errors, unplanned shut-downs have also been found to be responsible for break-downs, apart from the failures due to causes beyond control such as cyclones, lightning storms, natural calamities etc. Unauthorised tampering of power lines and sub-stations in rural areas and direct tapping of lines and theft of energy in some states have also been found to be contributing to break-downs and have thus considerably increased the maintenance problems. Public co-operation to put a stop to such malpractices is needed if rural electrification is to be taken to wider and remote rural areas. While all cares should be taken to ensure economic and proper planning and design of the rural power systems and use of good quality materials and equipment, it is of utmost importance that the equipment, and the lines that are already established are properly maintained in order to improve the viability of the schemes. Unfortunately this aspect has not yet received due attention of the State Electricity Boards except a few and the problem largely remains to be improved. With the multiple cropping and importance of the seasonal working of the irrigation pumps if the power supply is interrupted on account of bad maintenance, the country loses a lot apart from the loss incurred by the Electricity undertaking both in money and reputation. Loss of revenue to the extent of 5 to 7½% may be due to break-downs which could be improved by efficient maintenance.

CHAPTER VI

STANDARDISATION OF DESIGNS, SPECIFICATIONS OF MATERIALS AND EQUIPMENTS AND CONSTRUCTION PRACTICES

6.1.1 Standardisation of designs, specification of materials and equipments and of construction practices can provide the easiest and quickest way of achieving economy in Rural Electrification With a colossal amount of investment on rural electrification schemes to the extent of Rs. 450 crores during the Fourth Plan, raising to, may be, nearly 1500 crores during the Fifth Plan period, an economy of 15% could easily be brought about by standardisation, it would vastly increase the scope of rural electrification to wider and remote rural areas and at the same time would improve the viability of the rural electrification schemes.

6.1.2 No complex techniques are involved in erection of rural lines and sub-stations and there is little scope for the reduction of cost by further sophistication of technology. The work, though voluminous and involving considerable capital expenditure, is of repetitive nature. Great deal of economy would, therefore, be possible by streamlining and standardising administrative and construction procedures, standardising and simplifying construction methods, construction tools and equipment. Standardisation, variety reduction and lowering of cost by enabling mass production of all the equipment and fittings will yield substantial economies.

6.1.3 In a conference on standardisation of specification and construction practices in rural electrification sponsored by the Rural Electrification Corporation on January 4 and 5, 1971, it was observed that some of the State Electricity Boards were experiencing difficulty in putting up economically viable schemes because the power demands are scattered over a wide area and the intensity of the power demands are low in such backward areas. On the other hand, the schemes submitted for sanction by the various Electricity Boards indicate that there was considerable disparity in the cost structure of more or less identical units. It is, therefore, felt that there is considerable scope and need to adopt identical specifications where the conditions are similar.

6.1.4 The Rural Electrification Administration of U.S.A. which has done splendid work in the field of rural electrification during the last forty years could achieve its success largely due to the economic designs and practices adopted by the R.E.A. which has covered the entire range of designs, specification of materials construction and maintenance practices which have compulsorily to be adopted by all those who are financed by R.E.A. for rural electrification schemes in U.S.A.

6.1.5 The Indian Standards Institution, during nearly 23 years of its existence prepared many standards, many of which concern rural electrification. The CWPC had also prepared designs relating to the 11 kV feeder lines and L.T. lines for rural areas for various wind pressure regions which were circulated in 1958. The possibility of adoption of slightly lower standards for construction of rural lines commensurate with safe maintence and operation has been considered in various seminars with a view to effecting economy in cost. Recommendations have also been made for certain relaxations in the Indian Electricity Rules and the CWPC prepared revised designs, based on the suggested relaxation to rules and circulated the same to the State Electricity Boards as Rural Line Electricity Standards-Construction Manual based on the I. E. Rules, 1956. However, there are still large gaps in the formulation of standards for economic, designs, development of specification for materials and equipments and of construction practices and they need to be gone into with greater seriousness than hitherto as quickly as possible.

6.1.6 In view of the fact that the Indian Standards are not being conmpletely and uniformly adopted by the State Electricity Boards and the manufactures, it appears essential that some methods have to be developed to ensure that there is a continuous review of standardisation and enforcement of the Standards and Codes by all concerned, because it is only in that way, by strict implimentation that maximum economy in cost could be achieved. An important aspect of standardisation is variety reduction and the recent conference on Standardisation convened by the Rural Electrification Corporation went into this question of variety reduction in the case of transformers, conductors, supports, etc. Already there are national standards on these subjects and a recourse of practice, and what is most essential now is to aim at implementation of the existing standards and also simultaneously to develop further standardisation in the field of rural electrification.

6.1.7 A Technical Standards Committee at the national level as suggested in para 5.1.8 should be formed to work on standardisation and implementation of standards for achieving national economy. This Technical Standards Committee should bring out bulletins and books along with drawing and charts on the different aspects of rural electrification right from its conception to operation and maintenance of the completed rural electrification schemes. It should provide a standardised procedure and guides for the following :—

1. Investigation survey and system planning guide for electric distribution systems in rural areas.
2. Economic design of primary lines and substations for rural distribution schemes.
3. Electric system capacity of earmarked rural areas for intensive and integrated development.
4. Standards for the preparation of circuit diagrams electrical data sheets.
5. Construction work plans for rural schemes.
6. Single-phase designs and guide for design and selection of single-phase and three-phase systems for rural electrification schemes and comparative economic studies.
7. Guide for conversion of single-phase into three-phase systems.
8. Guide for economic selection of transformer size.
9. Specification drawings of wood pole lines and its construction.
10. Specification and drawings for 11 kV line construction.
11. Specification and drawings for 11 kV and 400 volt line (HT/LT) construction.
12. Specification and drawings for 66, 33, 22 kV line construction.
13. Specification and drawings for 66/33/22/11 kV sub-station construction and methods for determination of capacity and economic size of transformers.
14. Specification of line construction contracts.
15. Specification of sub-station construction contracts.
16. Guide for engineers for checking line and sub-station contract.
17. Guide for making an operation and maintenance survey of transmission and distribution systems.
18. Guide for repairs of distribution transformers switches, meters, etc.
19. Guide for voltage and current measurement on rural distribution system.
20. Guide for energy meters.
21. Guide for pole numbering and maintenance.
22. Guide for complete engineering, design and construction of rural electrification schemes.
23. Guide for design of civil construction works for different types of soils and rocky areas.
24. Guide for design and construction of service lines to consumer installations.

6.1.8 The above list indicates only some of the most important works which are required to be done urgently in the field of standardisation and is by no means comprehensive. In fact, standardisation of specification and drawings of a comprehensive list of materials and equipments required for Rural Electrification works along with a list of manufacturers who are registered for manufacturing and supply of materials would itself be voluminous work and would form a very large volume of work of this Technical Standards Committee. The large economy which is apparent from such efforts will however, justify the creation of this Committee to introduce a new approach and new methods in the field of Rural Electrification programme in this country.

6.2 In this connection, some of the specific suggestions concerning certain major aspects of designs which could economise in the rural electrification schemes are noted hereafter :

I. *Rural Lines :*

(a) *Supports*

The type of supports used for the rural lines varies from State to State. PSC, RCC, steel structural section, second hand rail poles, wood poles, jointed wood poles, fabricated poles etc. are used according to the availability. It is high time that one or two types which are most economical are adopted and should be easily made available. PSC and RCC poles in full lengths and also jointed appear to be the best choice under the prevailing circumstances except that of steel wire. The use of fly ash for partial substitution of cement for the fabrication of such poles should be done to economise in the cost. This practice is already in vogue in some States. The transport of PSC and RCC poles substantially affects the economics of the electric lines as transport is a costly item due to heavy weight and possibility of breakage of concrete poles over long distances. To over come this difficulty it is necessary that the fabrication should be decentralised at a number of suitable places in the rural for reducing the transport charges. It would be desirable that the location of the fabrication centre should be such that the poles are not generally required to be transported over a distance of 50 miles. The Indian Electricity Rules prescribe a factor of safety of 2.5 for these poles. Further relaxation may be considered in consistance with the safety of poles as well as quality of production.

(b) *Spans*

As the maximum span in a line is influenced by several factors viz., strength and size of conductor, height and strength of the pole, wind pressure and maximum temperature in the concerned area, spacing and circuit configuration etc., it is difficult to specify any standard span for rural lines. In this connection, it may however be mentioned that fewer supports per mile result in reduction in the number of insulators, cross arms, clamps and other accessories without in any way going beyond the limits of relaxation of ground clearance. It is, therefore recommended that the maximum possible span, say upto 150 metres, in all the areas should be employed as far as practicable.

(c) *Conductors*

In transmission and distribution lines various sizes of ACSRs are being used. Reducing the number of sizes of conductors would correspondingly reduce the requirement of accessories for the various sizes which are at present stocked. This would also enable one Board to take advantage of any surplus stock of the other. At the same time it would reduce the cost of handling and storage charges. The manufacturers of conductors would also have less sizes of conductors to concentrate upon and this would help them in planning in advance their manufacturing schedule to meet the requirements and would result in lower cost of production. In a Seminar, which was recently organised by the REC and attended by the senior representatives of the State Electricity Boards, it was decided that 0.03 and 0.05 sq. inch copper equivalent ACSR should be used both for 11 kV and low tension lines. What is perhaps important is that only economic standard sizes of ACSR after proper system study and optimisation should be adopted. All aluminium conductors are not to be entirely given up in low tension lines but wherever ACSR is not to be employed (in areas where the spans are short) .025 sq. inch (7/2.21 mm) and .05 sq. inch (7/3.1 mm) should be used.

(d) *Insulators and Fittings*

For lines upto 11 kV it may be possible to evolve standard size of egg-shaped insulators with necessary creepage distances and minimum flashover values for use at strain points without the necessity of providing metal clamps so that the cost of insulators can be reduced. It is understood that the Mysore State Electricity Board is experimenting with such type of insulators for HT and LT lines at strain points. Further research and experiments may be conducted to evolve a most economical type of insulator for rural areas. In the Seminar recently organised by the REC, it was agreed that 11 kV pin insulators with 540 kg. failing load as per IS would suffice. As regards disc insulators, it was agreed that insulators with minimum strength of 4500 kg. as per IS specification would be sufficient.

(e) *Conductor Spacing and Cross Arms*

It is seen that clearances between the conductors for rural lines varies from State to State. The clearance between the conductors is influenced by the span, wind, pressure, maximum temperature etc. With the standardisation of conductors and the spans it should be possible to evolve a standard clearance between the conductors for different regions. This would facilitate in standardising the size of the cross arms also. It is understood that it has already been done in case of the Eastern Region by Standardisation Committee. The other Regions should follow the suit.

(f) *Guy Wires*

It is found that the size of the GI Wires used for guying the poles varies from State to State. To reduce the cost of handling, storage charges, requirement of accessories etc. it is necessary that the size of the guy wire should be standardised. With the standardisation of conductors it should be possible to standardise the size of the guy wires. It is understood that this has already been done in the case of Eastern Region by the Standardisation Committee.

(g) *Anti-Climbing Devices and Danger Plates*

Installation of anti climbing devices and danger plates should be dispensed with in rural areas.

(h) *Auto-Reclosures*

It is necessary that the power to the rural consumer should be available whenever it is required. As the majority of the faults on the line are of temporary nature the use of auto reclosures will considerably increase the reliability of power and help in restoring the supply instantaneously. It is therefore recommended that the use of the auto-reclosures should be encouraged in rural lines.

(i) *Cradling*

In rural areas the cradling below 11 kV lines and that between 11 kV and low tension lines in the case of composite lines should be dispensed with except on strategic points such as crossings, etc.

(j) *Service Mains*

There is considerable scope effecting economy on the investment being incurred on erection of service mains/sub-mains by standardisation of the sizes of the bare conductors and insulated cables. The service mains should be erected with L.T. poles and bare conductors, preferably of size .02 sq. inch Cu Eq (Rose) to the maximum extent possible. The use of insulated cables for service mains/sub-mains should be restricted to the areas where erection of L.T. lines on poles is not feasible.

(k) *Multiple Earth Return*

Some States have successfully adopted the use of multiple earth return in low voltage systems where only one wire is used to serve both as neutral and earth wire and it is earthed at frequent intervals—at least 4 points in a mile. It may be stated that rule 67 of the Indian Electricity Rules, 1956, permits the above. It states "In the case of star-connected system with earthed neutrals or delta-connected systems with earthed artificial neutral points:

(i) The neutral point shall be earthed by not less than two separate and distinct connections with earth each having its own electrode at the generating station and may be earthed at any other point provided that no interference of any description is caused by such earthing;

(ii) In the event of an appreciable harmonic current flowing in the neutral connection so as to cause interference with communication circuits, the generator or transformer neutral shall be earthed through a suitable impedance."

In this connection, it would be interesting to note the practice followed in this regard in the United Kingdom. Regulation of the Electricity Supply Regulations, 1937 deals with connection with earth of systems for use at high voltage. It states:

> "The connection with earth shall, subject as hereinafter provided, be made at one point only in each system and the insulation of the system shall be efficiently maintained at all other parts."

However, further the same Rule states:

> "It shall not be permissible for the Undertakers to interconnect electrically systems for use at high voltage which are each connected with earth at one point, or except as hereinbefore provided, to connect any such system with earth at more than one point, unless electrical interconnection as aforesaid or connection with earth at more than one point is for the time being approved by the Electricity Commissioners with the concurrence of the Postmaster-General and is made in accordance with the conditions, if any, of that approval."

It would be seen that in U.K. the Electricity Commissioners have the powers to permit earthing of the neutral at more than one point even in high voltage lines with the concurrence of the Postmaster-General.

In multiple earth systems, an attempt is made to balance the load on the three-phases at different points as best as possible and with this no untoward incident has been reported. In view of this, it is suggested that multiple earthed systems may be adopted in the case of all rural low voltage lines where there is hardly any probability of interference with telegraph circuits. In fact, the State Electricity Boards should consider the application of this system in urban areas also.

सत्यमेव जयते

I. Labour and Transport:

Labour and transport forms about 15 to 20% of the total cost of lines. If the villagers can be enthused to supply labour and transport free of cost enormous savings could be effected which would result in electrification of more villages with the same funds. It is understood that some State Electricity Boards have already tried this "Shramdan" experiment in certain areas. The villagers offered free services for free transport and supply of free unskilled labour. Another advantage of such an experiment is that the villagers feel that these are their own works and see that no damage is caused. This should be extended on a large scale. For this purpose, it is necessary that the concerned officer of the State Electricity Boards are suitably trained in human relations, etc., so that they can enthuse and persuade the villagers to offer free labour and transport services, in a tactful manner.

II. 11/.4 *kV Sub-Station:*

The question of effecting economics in 11/.4 kV sub-station was discussed in a Seminar recently organised by the Rural Electrification Corporation. The cost of 100 KVA transformers 11/.4 kV pole sub-stations varies from Rs. 8305 to Rs. 15685. Standardisation of equipment and construction practices can bring about considerable reduction in the cost of rural sub-stations. The following suggestions are made in this regard:

(a) Some State Electricity Boards are using economical type of gang-operating switches. These switches are at present being made for a rating of 200 amperes. The full load current of a 100 KVA transformer at 11 kV is about 5.5 amperes; of course, the fault current will be much higher. There is scope for considerable reduction in the current ratings of isolating switches. The copper content on the blades of the switches and contacts could be considerably reduced. The State Electricity Boards may install some percentage of the sub-stations with the simplified gang-operating switches as above and gain experience. The method can then be further extended.

(b) Omission of 11 kV lightning arresters from transformers sub-stations upto 50 kVA in all the regions and upto 100 kVA in areas with low isoceraunic level. Instead arrester may be installed only at strategic points.

(c) Use of transformers with low iron loss and high copper loss. This will help in keeping the losses low as the load factor is very low in rural areas.

(d) In the Seminar organised by the Rural Electrification Corporation referred to above, it was decided that the use of 25 KVA 50/63 KVA and 100 KVA transformers should be standardised as this would help in considerable reduction of manufacturing costs. Decisions in the Seminar were also taken about omission of (i) Off-load tap changing switches from 25 KVA and 50 KVA transformers, (ii) Conservators, (iii) Filter valves, (iv) Rollers etc. If transformers are standardised and manufactured on these basis, considerable economies in their cost would accrue.

(e) Installation of transformers of capacities to match with the anticipated loads in only the next 2 to 3 years and avoiding installation of large capacity transformers as far as possible. In the continuous process of electrifiction, the transformers can be replaced after some years as may become necessary. This would result in initial capital saving as well as reduction in distribution losses.

(f) The low tension switch should be installed on the sub-station structure itself to economise on the length of low tension cables.

(g) Installation of small capacity transformers on single pole should be encouraged.

Service Reliability:

6.3.1 Service reliability in the growing rural electrification has received very little attention in the past. The village consumers, however, have been very critical of the lack of service reliability, of electric supply in the rural areas because unreliable power supply can cause very serious loss in the agricultural production and may make the whole programme of rural electrification meaningless. It is well-known that agricultural operations in this country are seasonal and the requirement of water for the crops is limited to certain specific periods only. It is of utmost importance that power supply to the irrigation pumps in the rural areas is ensured during these periods also. With the "green" revolution, gradually covering the entire country, which provides for multiple cropping, the need for continuous reliable power supply right round the year in the rural areas has become a matter of imperative necessity. Service reliability therefore, has assumed a new importance under the rural electrification programme. Beside, the demand for improving service reliability undoubtedly increases with system and load development. It is, however, to be seriously considered that large investments in rural electrification system solely for the purpose of service reliability could be seldom justified. At the same time relatively small expenditure for improving service reliability can go a long way in improving the power supply position in the rural areas and ensuring the large power supply during the agricultural seasons when it is mostly needed. In general the expenditure which can be justified depends on the degree of service, the number of consumers, the magnitude of the load and consumer's attitude. If the complaints are too frequent and too many, it may be worthwhile to undertake the remedial measures within the means for arriving at an economical solution of the problem. Mostly unreliable service in a distribution system is due to poor operating and maintenance practices. With very little additional expenditure it should be possible by vigilance and systematic arrangements and also with attention of the higher administration to improve upon the operation and maintenance efficiency. Sometimes, a distribution circuit may be too complex, at other times the equipments and materials used in the rural electrification schemes are of such poor quality as to create continuous problem of service reliability. Too many switches, fuses and cut-outs may create unnecessarily problems in maintaining the standard service reliability at the minimum level.

6.3.2 For evolving certain standards of service reliability in the rural area, it may be desirable to work out (a) a maximum permissible outage time for each class of load in the different seasons round the year, (b) an allowable pre-arranged shut-down time per consumer per year, (c) the critical periods during which power supply is essential for the irrigation and similarly for small industries, in the rural areas. It is obvious that after having decided upon standards, proper records and a careful vigilance and watch on the outage data have to be maintained in the rural areas by certain staff which should be responsible within their authority for providing solution to these problems. In analysing the outage data a distinction should be made between the consumer hour outages and number of outages, for example, ten outages on minor tap may affect relatively few consumers whereas one outage on a major feeder may affect many and cause a far greater number of consumer-hour outages. The emphasis, therefore, should be first on reducing the consumer hour outages on the system and then on reducing the number of outages. The operation and maintenance activities in the rural areas have necessarily to be geared up to increase service reliability.

This could be done by more frequent routine line patrolling, wider rights of way, by ensuring tree clearance, etc., more frequent right of maintenance, regular preventive maintenance of equipment and replacements of worn out and old equipment, efficient pole maintenance and pole numbering and hot-line maintenance wherever possible. There should be a continuous effort to minimise the time taken for receiving the report of an outage and for despatch of the maintenance staff for repairs, the time taken by the maintenance staff to go to fault locations, overall fault location time and repair have to be continuously analysed and reduced. A provision of emergency gangs to meet an emergency in the system is necessary which should be properly trained and provided with system maps, outlays and plans, transportation, housing and other facilities. For sub-station service reliability design aspects are very important and apart from providing spare transformers and spare equipment and even mobile sub-stations of suitable characteristics to be transported in all weathers, tie feeders for alternative supply may provide the emergency supply in case replacement of a defective transformer is not easily possible. Selection of the new sub-station sites should be made after due consideration of accessibility in all weather conditions. Automatic circuit reclosures have increased service reliability to a considerable extent in USA, U.K., France and other countries. There is, therefore, a case for consideration for increasing use of auto-reclosures for rural systems in this country as well.

6.3.3 Service reliability must be a continuous effort and therefore, it is necessary that there should be analysis of the service reliability results and there is a need for long range plan for system which may be included in every annual plan of each State Electricity Board. The funds provided therefor should be equated and reviewed year after year to gradually improve the service reliability standards in the rural areas.

सत्यमेव जयते

CHAPTER VII

TARIFF AND INCENTIVES FOR RURAL ELECTRIFICATION

7.1 **Tariff :**

7.1.1 Transmission and distribution system which serves agricultural loads, will have a heavy investment in transformers, and service lines for irrigation. More expensive distribution lines and sub-stations than are required in urban areas are necessary. Revenue from irrigation should cover the increase in expenses arising from this increased investment, the cost of power project for irrigation, allocated share of any other expense properly chargeable to irrigation. In other words, the cost of electricity at the consumer's terminals is higher in rural areas than that in urban areas.

7.1.2 The cost of power for irrigation will, of course, vary with the kWh and kW used by the rural consumers. All other expenses of irrigation service such as interest, depreciation, taxes, insurance, operation, maintenance, administrative and general expenses will remain fairly constant, depending largely on the total plant investment for providing service to the agricultural consumer and may be referred to as fixed cost. It is important that the irrigation rate be designed to recover fixed cost whether the consumers' kWh used in relation to connected kW (which depends on total hours of pumping) is great or small. During years when a consumer needs little or no irrigation, he is required to pay a minimum charge to cover a sufficient proportion of a share of the fixed cost. Because of the seasonal nature of their requirements it is necessary to design annual rates rather than the monthly type of rate. The kW charge is a fixed charge which entitles the consumer to the drawal of energy at a certain maximum rate and is also the minimum annual charge. It is a charge based on the individual consumer share of fixed cost, which depends on the kW of the motor served. Another important aspect of good irrigation rate is that the average rate per kWh should decrease as the consumer's number of hours of pumping increases, to an extent which will encourage the consumer to pump more hours and use the smallest motor consistant with efficient operation. The most desirable irrigation installation is the one resulting in the lowest combined expense to the consumer and the power supplier.

7.1.3 In the above method a question is often raised as to the desirability of a fixed charge per kW which does not include payment for any kilowatt hours used. Consumers usually object to any charge for which they receive no energy. In India it is the practice of the State Electricity Boards and the Utilities to levy a minimum power consumption guarantee in the case of agricultural consumers. A suitable minimum guarantee charge for electricity is likely to lead to community utilisation of equipment such as for lift irrigation. This will encourage installation of network of lift irrigation schemes by co-operatives and may result in the pooling of resources of small cultivators enabling them to derive the benefits of rural electrification which have been denied to them so far. If the minimum guarantee charge is kept sufficiently high it will improve the demand factor as well as load factor. It adversely affects those persons who are guilty of excessive under-capacity utilisation of equipments. Its incident is also more equitable than the sliding rate of tariff where a consumer using 1 kW pump is charged the same rate as one using 10 kW pump even when the former's consumption of energy is one-tenth that of the latter. There is also an incidental benefit from the system, minimum guarantee charge makes the theft of energy (by meter, manipulations, etc.) less remunerative. On the other hand, high minimum consumption guarantee charge discourages the farmer from using electricity for pump sets. It is also argued that levy of minimum charge is only psychological as the cost of actual consumption of units generally surpasses the minimum guaranteed charges. Thus a suitable balance between the two has to be arrived at.

7.1.4 Annexure VIII gives the minimum guarantee as is at present being charged by the various State Electricity Boards. It would be seen that this varies from Board to Board. The Bihar State Electricity Board has totally abolished the minimum guarantee with effect from 1st August, 1970. In the case of U.P. the minimum guarantee is the highest at Rs. 120/- per BHP year with effect from 1-7-1970.

7.1.5 Annexure IX gives tariff for small industrial consumers in various States having connected load of 10 HP at the rate of 15% load factor. Here also minimum power consumption guarantee has been imposed by the various State Electricity Boards. The minimum consumption guarantee required is very high in the case of some States, for instance, it is Rs. 120/- per BHP year of contracted load in U.P. and Rs. 84/- per BHP year in Rajasthan, Rs. 60/- per BHP year in Andhra Pradesh and Mysore etc. It is recommended that for agricultural loads as well as for rural industries, the minimum power consumption guarantee should be reduced to a reasonable figure. These annexures also give average rate in paise per kWh and electricity duty in paise per kWh charged from the agricultural and industrial consumers by the various State Electricity Boards.

7.1.6 It would be seen from both the Annexures (VIII & IX) that the load factor in each case is only of the order of 15%. This is so because, agricultural loads are only seasonal and operate only for a few hours in the year. In the case of agricultural consumer the usage of energy is small, both demand and energy costs are small and the cost of service consists principally of expenses incident to the investment made to extend service and the cost of billing and collecting. Therefore, when a small consumer increases his energy usage, the cost per kWh declines rapidly. In order to reduce the rates further it would therefore be necessary that the load factor of the rural loads should be considerably increased. One way to improve the load factor in rural areas would be to permit the consumer to use electricity for other purposes whenever it is not required for pumping water. This information was asked in the questionnaire circulated to various States. The replies received from some of them are included in the enclosed Appendix.

7.1.7 The farmers should be encouraged to use electrical agricultural machinery like chaff cutters, threshers, etc., in the fields. With the multiple cropping pattern it should be possible to increase the use of electricity in the field. At present the consumption of electricity in the field depends on the number of working hours during a day, which in turn depends on the duration of day time. They should be encouraged to work in the fields after sunset. For this they should be allowed to use light points at the same rate. This would go on long way in improving the load factor in rural works. The farmer should be encouraged to work in the fields during off peak periods so that maximum demand of the system does not increase due to agricultural loads.

7.1.8 Annexure XI indicates the rates of electricity for agricultural purposes in various countries during the year 1968.

7.2 **Incentives :**

7.2.1 The use of electricity in rural areas will result in revolutionising the agricultural and industrial economy of the villages and also go a long way in modernising habits and social activities. For the country to progress, it is essential that the economic lot of the villagers who constitute about 80% of the country's population is improved considerably. The use of electricity has, therefore, to be spread in rural areas as best as possible. However, it has to be remembered that at present the bulk of the villagers are poor and do not have the means to finance purchase of pump sets, electric driven appliances etc. Therefore, considerable incentives are required to be provided to encourage them to go in for the use of electric power. A few of these are enumerated below :—

(i) The first thing is that the rate for supply of power should be as low as possible. If the State Electricity Boards and the Electric Utilities are not to incur any losses, it is but fair that the rate at which energy is sold should be arrived at after making provision for all necessary expenses connected with generation, transmission and distribution charges, including depreciation and interest charges. It is, therefore, imperative that generation, transmission and distribution costs are reduced to the minimum.

It is recognised that in some States like-Assam, Orissa etc. the cost of generation, transmission and distribution may be quite high and it may not be possible for the farmers to pay for the use of electricity on the basis of the actual cost of power delivered. If this is enforced it would work as disincentive for utilisation of power in rural areas. In such cases the State Electricity Boards may consider charging for rural supplies at rates lower than their actual cost and within the reach of the rural consumer by suitably compensating this loss by sale of power to other industrial and urban consumers. Where this is not feasible the Central and State Governments should consider subsidising the State Electricity Boards for the losses incurred by them on this account. The average rates for agricultural consumers in different States are given in Annexure-IX. It would be seen that it varies from 9 paise in Kerala to 18 paise. In Maharashtra, the average actual cost of power delivered to rural consumer works out to about 18 paise per kWh. The prevailing rates in most of the States therefore appear to be lower than their actual costs. The rates in most of the States have not been fixed on economic consideration but because of various other factors such as State policies and historical background. It is very difficult to suggest one rate for this purpose for the entire country because the conditions and distribution vary from State to State.

The question of reduction in generation costs has been discussed at length in the Report of Study Group No. 3. Besides other factors, transmission charges can be considerably reduced by integrated operation of the regional power systems. This has been discussed in detail in the Report of Study Group-2. If, therefore, the recommendations contained in the Reports of Study Groups 2 & 3 are implemented, considerable reduction in generation and transmission charges in the coming years can accrue. The question of reduction in the cost of the rural distribution schemes consisting of sub-stations required for electrification of villages has also been dealt with in the foregoing chapters.

(ii) It would be seen from Annexures VIII & IX that electricity duty is at present being levied by some States on sales of power for agricultural and industrial purposes. It is but fair that the revenue collections from the electricity duty should be ploughed back for rural electrification schemes for accelerated expansion of electric supply to wider areas.

(iii) For distances exceeding 100 ft. from the distribution main, the State Electricity Board should provide free service connections beyond a certain limit of cost in order to extend electricity to smaller farmers located in distant places. In Tamil Nadu, this has been fixed at Rs. 60/- but a reasonable cost limit could be fixed by each State depending on their financial conditions and economic conditions of agriculturists.

(iv) Agricultural services should be allowed installation of three light points for farm use and the consumption up to connected load of 300 watts therefor charged at the agricultural tariff. SEB should also allow the use of agricultural machinery like threshers, chaff cutters, etc., at the same tariff.

(v) Co-operative use of agricultural machinery like threshers, chaff cutters and multifarious electrically driven farm and domestic appliances should be arranged and encouraged. The rural electric co-operatives which are being set up in the States should try this experiment. The advantages of such an arrangement have been discussed in the foregoing.

(vi) Agricultural services should not be disconnected if there are standing crops. For settlement of such disputes, the State Govt. should set up an appropriate machinery under the Govt. Electrical Inspectorates and evolve suitable procedure for the same.

(vii) Loans for purchase of electric motors and pumps as also other farm appliances repayable in easy instalments should be made available to the farmers by the concerned Central and State Agencies or by Govt. sponsored private Agro-industrial Complexes.

(viii) The farmers have not been used to the use of electricity in the past. Whenever they have to get the wiring done either for the pumping set or for their residences, they have to go a long way to cities to get the contractors for the work. Owing to the long distances involved and non-familiarity of the farmers about the reasonable charges for this kind of work, the contractors charge them exorbitantly for the work done by them. Again, when any maintenance or repair work has to be done, the farmers have to pay heavily for the same. With the growth in the consumption of electricity and the dispersal of electrification to the rural areas, the demand for technicians should increase considerably. Although there are a large number of unemployed technical personnel in the country at large, yet they are just not available in the rural areas. In most of the States, the farmers find it difficult to have the maintenance and servicing of dispersed pump sets carried out at short notice. There is a large gap between the requirement and the availability of personnel trained in jobs like line work, servicing, maintenance and internal wiring in rural areas. With a stepping up of the programme, the shortage is likely to increase and may lead to serious bottlenecks and delays. It is, therefore, considered imperative that the State Govts. should formulate suitable rural technical centres of groups of unemployed technical personnel and help them to offer their services to the farmers for which suitable incentives should be provided. It may be necessary to subsidise such centres at the initial stages. Arrangements whereby the people in rural areas can also get the above things done at reasonable charges have to be considered. For this purpose, special "rural electricity service centers" and "rural mobile servicing squads" will have to be organised. It would be best if either the State Electricity Departments of the State Electricity Boards form their units at different locations who are able to take up the work of wiring maintenance etc. for the rural people on reasonable charges. It is recognised that the State Electricity Boards are at present encumbered with multifarious duties and works comprising generation, transmission, distribution, supply of power to a very large number of consumers, rural electrification etc., take almost all their time and are perhaps hesitant to spread out their activities further in some other directions. Study Group 5 which is dealing with the question of avoiding delays in construction of power projects has come to the conclusion that the Chairmen and Members of the State Electricity Boards have to attend to the complaints of the consumers, general and financial matters and this takes away a lot of their time. With this, perhaps, they are not able to find the required time for exercising personal supervision and control over the major construction works as for instance top management in a private company would do. Study Group 5 has, therefore, suggested that every State Electricity Board should have two separate Wings—one charged with the responsibility of planning, construction and operation of generating stations and transmission systems of 220 kV and above and the other charged with the responsibility of planning, construction and operation of transmission lines upto 132 kV, distribution systems, rural electrification, etc. If these suggestions are implemented, it should not be difficult for the second Wing of State Electricity Board to organise erection and maintenance services in rural areas.

(ix) As pointed out earlier, rural electrification can also be promoted by establishing experimental electrified farms where electricity could be used round the clock for multifarious purposes.

These farms will set an example to the farmers as to how the power could be best utilised to improve upon their economic condition and also it will improve the utilisation. These farms will also serve the purpose of supplying necessary data to the electric utilities as to how the consumption of farms can be increased and as to how the load factor can be improved.

(x) The applicants from rural areas often complain of difficulties in getting electric connections and among the difficulties the one mentioned most often is long time-lag between the date of application and the date of getting the connection. This point was examined by the Programme Evaluation Organisation of the Planning Commission and some data in this behalf is furnished in Table 9.10 (page 209) of their report on Evaluation of the Rural Electrification Programme—1965. This table is reproduced below :

TABLE 9.10

Average time-lag in getting connections for different categories of load in the years 1956 to 1961

Year	Agricultural		Industrial		Commercial		Domestic	
	Total No. of connections	Average time-lag in months	Total No. of connections	Average time-lag in months	Total No. of connections	Average time-lag in months	Total No. of connections	Average time-lag in months
1956	24	9.2	20	4.4	22	1.4	62	1.8
1957	38	13.0	31	5.2	26	1.6	119	2.4
1958	48	9.2	61	6.1	31	3.2	165	2.6
1959	43	9.1	58	5.4	62	3.0	168	3.4
1960	28	11.9	47	8.5	41	4.7	105	4.3
1961	18	12.9	20	8.3	3	2.0	37	3.4
TOTAL .	199	10.6	237	6.3	185	3.0	656	3.0

The average time-lag in getting connections was highest (10.6 months) for agricultural load; then came that for industrial load (6.3 months). The smallest delay (3 months) occurred for other connections. This position existed in each of these six years. Further, for agricultural and industrial loads, the lag seems to have been increasing in the later three years, 1959-61. Even for commercial and domestic connections, the average lag for the three years 1959-61—3.2 and 3.7 months—was greater than that for 1956-58—2.1 and 2.3 months, respectively.

It would be seen from the above, average time-lag is the highest in getting agricultural connections. It is, therefore, essential that proper steps be taken and procedures streamlined by the State Electricity Boards to ensure that applicants for agricultural connections are supplied with power within a very reasonable time (in no case it should exceed 3 months).

CHAPTER—VIII

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

8.1 Electricity has now become a necessity rather than an amenity and must be recognized as an important factor in economic progress even in rural areas. The higher production of food grains required to meet the minimum demand of 1975-76 can be achieved economically only through extensive irrigation electrification of pump sets and by using modern electric equipment on the farmsteads.

8.2 There is considerable scope for effecting economy in the equipment, construction practices, designs etc. for rural electrification and also in the basic cost of power as discussed in the different Study Group Reports already.

8.3 The N.C.A.E.R. studies on Punjab and Kerala have conclusively established the socio-techno-economic benefits from rural electrification.

8.4 The N.C.A.E.R. study shows larger benefit/cost ratio for smaller villagers. This indicates desirability of extension of rural electrification to cover smaller villages notwithstanding the lower percentage of return on the capital employed.

8.5 PEC estimate of progress:

	As on 31-3-69	During 1969-74	During 1980-81
No. of villages . . .	71,410	53,590	1,40,000
Pump sets . .	10,88,696	15,00,000	28,11,000
Investment (Rs. crores) . .		520	1,850

8.6 Availability of underground water and absence of salinity should be checked before any scheme for electrification of tube-wells is sanctioned. A survey of groundwater resources should be conducted in the potential scheme areas and data in this respect kept ready by the State Electricity Boards. This work could, perhaps, be carried out by the Department of Agriculture or the Underground Water Organisation in the State. Assistance could also be obtained from the Geological Survey of India and Exploratory Tube-well Organisation of the Union Ministry of Agriculture.

8.7 Cooperative use of the tube-wells should be encouraged. This would help in pooling up of the resources for taking tube-well connection. Cooperative use of tube-wells and selling of tube-well water would increase the load factor and improve the economics of rural electrification.

8.8 Finances:

Investment upto 1968-69 provided by earmarked Central assistance was Rs. 254.00 crores. An estimate of financial resources for the 4th Plan is as follows :—

	(In crores of Rs.)
(i) Fourth Plan outlay by the State/Union Territories etc.	294.50
(ii) Rural Electrification Corporation . .	150.00
(iii) Financial Institutions comprising .	75.00

(a) Land Development Banks.
(b) Agricultural Refinance Corporation.
(c) Commercial Banks.
(d) Agricultural Finance Corporation.
(e) Life Insurance Corporation.

8.9 **Rural Electrification in India can spread rapidly if it takes the shape of a people's movement. As pilot projects, the Government have set up five rural electric Cooperatives-one in each of the States of Andhra Pradesh, Gujarat, Maharashtra, Mysore and U.P. The Cooperatives will enthuse the spirit of ownership in the villages and would also facilitate cooperative use of pump sets, electric appliances such as threshing machines, drying facilities for fruit, cold storage facilities etc. This will not only help the poor farmer to use such costly appliances but would also result in the improvement of the load factor in the rural areas.

8.10 It is felt that, in order to accelerate the development of rural areas, the easiest and quickest way would be to integrate rural electrification programmes with the programme of agricultural and other rural industrial development schemes. It is recommended that Co-ordination Committees should be set up (1) at the level of the State Electricity Boards and (2) at the District level, as suggested in the meeting in Planning Commission in July, 1970.

8.11 The work of rural electrification though voluminous and involving considerable expenditure, is of repetitive nature Therefore, there is a very large scope for achieving economy by standardized designs, manufacture and construction practices in the field of rural electrification. The specific suggestions concerning certain major aspects of designs for rural lines and sub-stations which could economise in the rural electrification schemes have been given in the Chapter 6 of this Report. It is recommended that the same may be followed.

8.12 A special Technical Standards Commmittee should be formed for simplifying and standardising materials and Code of construction practices for rural electrification works. This Committee should have a permanent Secretariat and should work in co-ordination with the CWPC, ISI, REC, manufacturers and Research Organisations.

8.13 Single phase power distribution is inherently cheaper than 3-phase power distribution and deserves consideration. Chapter 5 indicates the development work already done in India on this. This system is very effective for villages with small loads, especially those with a population of upto 500 (which number a about 3.67 lakhs).

8.14 Break-downs in power supply are mostly (60-90%) on account of failures of distribution lines and sub-stations. Standardized plans for operation and maintenance of these should be evolved (see chapter 6).

8.15 Minimum consumption guarantee for agricultural consumers should be reduced to a reasonable figure.

8.16 There is considerable scope for increasing the load factor in the rural areas.

8.17 Suitable incentives are required to be provided to encourage the farmers to go in for the use of electric power (Para 7.2).

8.18 Rural electrification could be viable and successful if the integrated development of the rural area be done on an intensive basis by Agriculture, Irrigation Industries Departments etc. of the State Govt. in conjunction with the State Electricity Board.

**(iv) Backward areas should be given due consideration in rural electrification programme.

(v) State Govt. should give loans on easy terms to State Electricity Boards for Rural Electrification.

ANNEXURES

सत्यमेव जयते

सत्यमेव जयते

LIST OF ANNEXURES

ANNEXURE No.	TITLE	PAGE
I	Villages Electrified—1951 to 31-10-1970	46
II	Irrigation pumpsets/Tubewells Energised	48
III	Villages Electrified as on 30-6-70 and Approximate percentage of their population	49
IV	Number of Towns and Villages Supplied with Electricity, 1967	50
V	Map Showing Groundwater possibilities in India	52
VI	Outlay for Rural Electrification and Targets of Energisation of Additional Pump sets in the Fourth Five Year Plan	53
VII	Cost of 11 KV lines per K.M.	54
VIII	11/0.4KV, 100 KVA Transformer substation	62
IX	Tariff for Agricultural Consumers in Various States with 5 HP or 10HP connected load@15% L.F.	68
X	Tariff for Small Consumers in various States with 10HP connected load @15% L.F.	69
XI	Comparison of Average Electricity rates for Agriculture in Various Countries	70

सत्यमेव जयते

ANNEXURE 1

VILLAGES ELECTRIFIED

States/Union Territories	Total No. of Villages	Number of Villages Electrified as on											
		31-3-51	31-3-56	31-3-61	31-3-66	31-3-69	% electrified	31-3-70	% electrified	2-10-70	% electrified	31-10-70	% electrified
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Andhra Pradesh	27,084	119	517	2,443	4,099	5,497	20.2	6,976	25.7	7,318	27.0	7,352	27.1
Assam	25,702	..	..	20	89	380	1.4	575	2.2	604	2.3	604b	2.3
Bihar	67,665	4	300	2,202	3,561	5,967p	8.8	7,306	10.8	7,692	11.3	7,692b	11.3
Gujarat	18,584	37	130	678	1,671	2,875	15.5	3,386	18.2	3,691	19.9	3,748	20.2
Haryana	6,669	..	99	570	1,179	1,464	21.9	3,367	50.7	4,983	74.5	5,885	88.3
Jammu & Kashmir	6,559	..	..	21	434	683	10.4	763	11.6	771a	11.8	771a	11.8
Kerala	1,573	159	380	869	1,080	1,134	72.1	1,164	73.9	1,193	76.0	1,194	76.0
Madhya Pradesh	70,414	9	47	373	1,133	2,754	3.9	5,050	7.2	5,240	7.3	5,328	7.6
Maharashtra	35,851	33	237	764	4,273	9,450	26.4	10,058	28.0	10,976	31.0	11,071	31.0
Mysore	26,377	625	1,593	2,756	4,085	6,118	23.2	7,671	29.1	7,882	30.0	7,936	30.8
Nagaland	814	..	..	..	5	27	3.5	49	6.0	65	8.0	65	8.0
Orissa	46,466	Nil	25	118	534	812	1.7	950	2.0	1,050	2.3	1,073	2.3
Punjab	11,947	66*	593*	2,041*	3,623*	4,423p*	37.0	5,509*	46.2	6,104*	51.2	6,131*	51.2
Rajasthan	32,241	3	7	41	1,122	2,103	6.2	2,561	7.9	2,776	8.6	2,809	0.7
Tamil Nadu	14,124	1,495*	2,430*	5,919*	7,208	8,778	62.2	10,272	72.8	10,793	76.4	10,901	77.2
Uttar Pradesh	1,12,624	581	2,557	4,866	6,788	12,810	11.4	17,389	15.5	19,629	17.4	19,674	17.4
West Bengal	38,454	386	553	920	1,594	2,435	6.3	2,621	6.8	2,819	7.8	2,822	7.8
TOTAL (STATES)	5,43,148	3,517	9,468	24,601	42,478	67,710	12.5	95,667	15.7	93,576	17.2	95,056	17.5

Union Territories :													
N. Islands	399	9	12	15	22	27	6.7	29	7.3	30	7.5	30	7.5
Chandigarh	31	Nil	Nil	Nil	3	16	51.6	20	64.5	21	67.7	21	67.7
N. Haveli	72	Nil	Nil	2	3	4	5.5	6	8.3	11	15.3	11	15.3
Delhi	276	24	24	35	274	276	100.0	276	100.0	276	100.0	276	100.0
Goa, Daman & Diu	245	..	3	4	15	58	23.7	98	40.0	115	45.5	115	45.5
Himachal Pradesh	13,060	1	22	545	1,268	2,788	21.4	3,579	27.4	3,883	29.8	3,883b	29.8
LMA Island	10	Nil	Nil	Nil	4	6	60.0	7	70.0	7	70.0	7	70.0
Manipur	1,866	Nil	Nil	17	67	122	6.5	157	8.4	161	8.7	166	8.7
NEFA	2,451	Nil	Nil	1	21	46	1.8	46	1.9	46	1.9	46	1.9
Pondicherry	388	72	79	216	300	309	79.6	320	82.4	330	85.0	330	85.0
Tripura	4,932	Nil	Nil	17	39	48	0.9	58	1.1	53	1.1	54	1.1
TOTAL (U.T.)	23,730	106	141	352	2,016	3,700	15.6	4,591	19.3	4,933	20.8	4,939	20.8
TOTAL (ALL INDIA)	5,66,878	3,623	9,609	25,453	14,494	71,410	12.6	90,258	15.9	98,509	17.5	99,995	17.6

Figures relate to 1961 census.
Figures as on 31-3-1970; 2-10-1970 and 31-10-1970 are provisional.
*As per 1951 census
a As on 15-7-1970
b As on 2-10-1970
p. Figures provisional
Figures estimated.

ANNEXURE II

IRRIGATION PUMPSETS/TUBEWELLS ENERGISED

States/Union Territories	Number Energised ending March						As on
	1951	1956	1961	1966	1969	1970	31-10-70
1	2	3	4	5	6	7	8
Andhra Pradesh	N.A.	N.A.	17,958	57,225	1,23,888	1,57,644	1,70,357
Assam	Nil	Nil	Nil	Nil	54	57	67
Bihar	47	697	3,200	10,660	50,005	56,422	60,564a
Gujarat	910	2,825	6,963	17,155	41,859	55,604	62,035
Haryana	N.A.	743	3,526	15,220	45,385	68,241	75,582
Jammu & Kashmir	N.A.	10	85	104	162	178	217
Kerala	N.A.	N.A.	2,666	6,957	13,909	18,679	21,004
Madhya Pradesh	Nil	30	1,822	7,314	31,469p	37,173	46,500
Maharashtra	142	2,166	7,219	44,978	1,24,992	1,61,126	1,82,376
Mysore	2,460	8,003	16,888	42,371	91,826	1,10,423	1,19,369
Nagaland	Nil	Nil	Nil	Nil	Nil	1	1
Orissa	N.A.	N.A.	N.A.	N.A.	477	580	609
Punjab	N.A.	3,095	8,514	25,296	56,112	79,036	86,917
Rajasthan	30	47	1,100	6,962	19,154	25,432	28,020a
Tamil Nadu	14,373	32,440	1,17,695	2,56,594	4,02,239	4,70,776	4,99,916
Uttar Pradesh	747	1,629	3,811	17,591	75,465	1,02,884	1,11,812
West Bengal	N.A.	N.A.	56	437	1,193	1,319	1,319b
TOTAL (STATES)	18,709	51,685	1,91,503	5,08,864	10,81,189	13,45,575	14,66,665
Union Territories :							
A. & N. Island	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Chandigarh	Nil	N.A.	1	99	172	215	262
D. & N. Haveli	Nil	Nil	Nil	Nil	32	39	43
Delhi	Nil	Nil	5	673	2,884	3,991	4,450a
Goa, Daman & Diu	Nil	Nil	Nil	6	42	75	154
Himachal Pradesh	Nil	2	20	88	197	426	431c
LMA Islands	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Manipur	Nil	Nil	Nil	Nil	Nil	Nil	Nil
NEFA	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Pondicherry	N.A.	282	1,347	3,291	4,178	4,531	4,746
Tripura	Nil	Nil	Nil	Nil	2	3	8
TOTAL (U.Ts)	Nil	284	1,373	4,157	7,560	9,280	10,094
TOTAL ALL INDIA	18,709	51,969	1,92,1876	5,13,021	10,88,696	13,54,855	14,76,759

a—As on 30-9-1970
b—As on 31-3-1970
c—As on 30-4-1970
p—Provisional
Figures as on 31-3-1970 and 31-10-1970 are provisional.

ANNEXURE III

VILLAGES ELECTRIFIED

States/Union Territories	Total No. of villages	No. of electrified as on 30-6-70	Approximate percentage of Rural population comprising the electrified villages as on 30-6-1970
Andhra Pradesh	27,084	7,346	48.7
Assam	25,702	580	5.8
Bihar	67,665	7,509	23.9
Gujarat	18,584	3,477	39.2
Haryana	6,669	3,525	64.8
Jammu & Kashmir	6,559	771	24.0
Kerala	1,573	1,166	82.9
Madhya Pradesh	70,414	4,904	16.5
Maharashtra	35,851	10,323	46.7
Mysore	26,377	6,642	40.3
Nagaland	814	50	11.4
Orissa	46,466	988	7.1
Punjab	11,946	5,581*	63.1
Rajasthan	32,241	2,515	18.5
Tamil Nadu	14,124	9,531	75.8
Uttar Pradesh	1,12,624	16,035	28.5
West Bengal	38,454	2,734	16.1
	5,43,148	83,677	35.1
Union Territories :			
A. & N. Islands	399	29	10.3
Chandigarh	31	20	83.5
D. & N. Haveli	72	6**	23.5
Delhi	276	276	100.00
Goa, Daman & Diu	245	107	44.1
Himachal Pradesh	13,060	3,610	27.3
L.M.A. Islands	10	7	88.9
Manipur	1,866	150	31.8
N.E.F.A.	2,451	46	16.1
Pondicherry	388	320	92.2
Tripura	4,932	53	5.7
TOTAL (U.Ts)	23,730	4,633	31.7
TOTAL (ALL-INDIA)	5,66,878	88,310	35.0

Figures relate to 1961 Census.
*As per 1951 Census.
**At the end of May, 1970.
Sources : CWPC.

सत्यमेव जयते

ANNEXURE IV

NUMBER OF TOWNS AND VILLAGES ELECTRIFIED—1967

Country	Particulars	Villages & Towns having Population of											
		Over 100,000		Between 100,000 & 50,000		Between 50,000 & 10,000		Between 10,000 & 5,000		Between 5,000 & 1,000		Below 1,000	
		Number	Aggregate Population	Number	Aggregate Population	Number	Aggregate Population	Number	Aggregate Population	Number	Aggregate Population	Number	Aggregate Population
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Afghanistan	Total	2	554.0	13	880.0	14	500.0	..	..	..	..	..	..
	Electrified	2	387.0	7	180.0	7	105.0	..	..	..	..	..	..
	Percentage	100	69.7	54	20.5	50	21.0	..	..	..	..	..	..
Australia	Total	6	4258.9	5	284.0	33	627.2	39	289.3	..	2691.1	..	992.5
	Electrified	6	4258.9	5	284.0	33	547.1	39	267.0	384.0	512.9	3098.0	867.1
	Percentage	100	100.0	100	100.0	100	87.4	100	92.4	..	19.9	..	87.3
Burma	Total	3	..	2	..	54	..	60	..	2100.00	..	31760.0	—
	Electrified	2	..	2	..	54	..	60	..	176.0	..	408.0	..
	Percentage	100	..	100	..	100	..	100	..	8.4	..	1.3	..
China(Taiwan) . . .	Total	11	3982.6	37	2415.4	236	6664.1	23	178.0	17.0	56.5	..	...
	Electrified	11	3982.6	37	8415.4	235	6454.0	21	166.6	13.0	45.1	..	—
	Percentage	100	100.0	100	100.0	99.6	99.8	91.3	93.6	76.5	79.8	..	...
India . . .	Total	107	35124.0	139	9529.0	2114.0	39343.0	4268.0	28672.0	562949.0	326404.0	c	c
	Electrified	107	35124.0	139	9529.0	2022.0	37628.0	3152.0	21174.0	559476.0	34485.0	c	c
	Percentage	100	100.0	100	100.0	95.6	95.6	73.9	73.0	10.6	10.6	c	c
Indonesia	Electrified	28	..	20	..	73.0	—	77.0	..	52.0	—	..	...
Iran	Total	14	5900	16	1160.0	98.0	2131.0	116.0	750.0	2381.0	4047.0	64243.0	11000
	Electrified	14	4584	16	1160.0	98.0	1212.0	116.0	180.0	361.0	..	1264.0	..
	Percentage	100	75.6	100	64.7	100.0	56.8	100.0	24.0	15.1	..	2.0	..
Japan	Total	140	..	172	..	1568.0	..	1086.0	..	340.0	..	11.0	..
	Electrified	140	..	172	..	1568.0	..	1086.0	..	340.0	..	11.0	..
	Percentage	100	..	100	..	100.0	..	100.0	..	100.0	..	100.0	..
Korea Republic of—All over the country 1525281 customers (about 34 per cent) are supplied with electricity.													
Malaysia (State of Malaya) .	Total	..	1278.6	..	611.5	..	646.0	..	202.0	..	181.9	..	68.0
	Electrified	6	225.4	8	121.0	29.0	189.2	29.0	83.8	65.0	91.3	78.0	29.0
	Percentage	..	17.5	..	19.8	..	29.3	..	40.2	..	50.2	..	42 7

Sabah	Total	..	..	..	..	2	..	2	..	7	..	..	..
	Electrified	..	..	..	..	2	..	2	..	7	..	..	..
	Percentage	..	..	..	..	100	..	100	..	100	..	..	..
Sarawak	Total	..	..	1	..	2	..	4	..	..	..	..	..
	Electrified	..	..	1	..	1	..	4	..	..	..	..	..
	Percentage	..	..	100	..	50	..	100	..	..	..	..	..
Nepal	Total	1	..	2	..	21	1000	..	..	..	..	..	..
	Electrified	1	..	2	..	14	100	..	..	..	..	..	..
	Percentage	100	..	100	..	70	10	..	..	..	..	..	..
Philippines	Total	18	4991.5	82	5391.2	967	21585	416	2538	Included in the 10,000—5,000 Population group.			
	Electrified	18	4991.5	68	4650.1	464	11697	44	383.2				
	Percentage	100	100	84.1	86.2	48	54.2	10.6	11.2				
Thailand	Total	43	5332.8	240	13845.3	334	9859.5	51	392.1	10	39.2	..	..
	Electrified	28	79.7	199	2951.1	242	1538.2	37	182.3	6	17.5	..	..
	Percentage	65.1	1.5	83	17.5	72.5	15.6	72.6	46.5	60	44.5	..	..
Vietnam	Electrified	3	2163	9	580.0	28	69	..	..	6	..	..	..

(a) No data available for Brunei, Cambodia, Ceylon, Hongkong, Mangolia, Pakistan, Western Sanoa. 99.7 per cent of the population in New Zealand received a supply.

(b) Provisional.

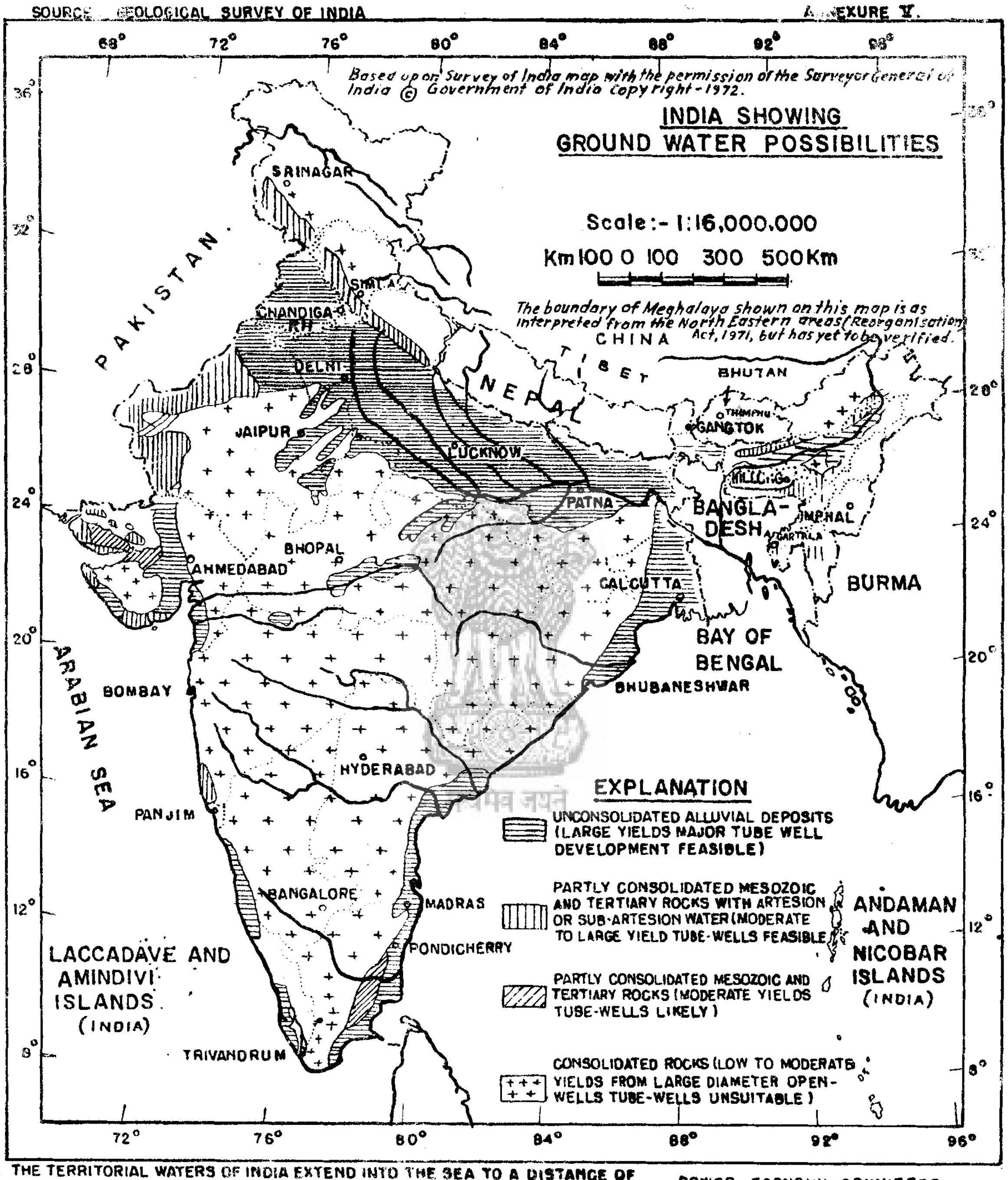
(c) Included in the corresponding columns (11 & 12).

(d) 99.99 per cent of total residential houses have been supplied with electricity.

Source : *Electric Power in Asia and the far east* 1967—*U.S. Publication.*

SOURCE GEOLOGICAL SURVEY OF INDIA

ANNEXURE V.


Based upon Survey of India map with the permission of the Surveyor General of India © Government of India Copyright-1972.
INDIA SHOWING GROUND WATER POSSIBILITIES
Scale:- 1:16,000,000
Km 100 0 100 300 500 Km
The boundary of Meghalaya shown on this map is as interpreted from the North Eastern areas (Reorganisation) Act, 1971, but has yet to be verified.
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°
CHINA
TIBET
NEPAL
BHUTAN
PAKISTAN
SRINAGAR
SIMLA
CHANDIGARH
DELHI
JAIPUR
LUCKNOW
PATNA
THIMPHU
GANGTOK
SHILLONG
IMPHAL
AGARTALA
BANGLA-DESH
BURMA
BHOPAL
AHMEDABAD
CALCUTTA
BAY OF BENGAL
BHUBANESHWAR
ARABIAN SEA
BOMBAY
HYDERABAD
PANJIM
BANGALORE
MADRAS
PONDICHERRY
TRIVANDRUM
LACCADAVE AND AMINDIVI ISLANDS (INDIA)
ANDAMAN AND NICOBAR ISLANDS (INDIA)
EXPLANATION
UNCONSOLIDATED ALLUVIAL DEPOSITS (LARGE YIELDS MAJOR TUBE WELL DEVELOPMENT FEASIBLE)
PARTLY CONSOLIDATED MESOZOIC AND TERTIARY ROCKS WITH ARTESION OR SUB-ARTESION WATER (MODERATE TO LARGE YIELD TUBE-WELLS FEASIBLE
PARTLY CONSOLIDATED MESOZOIC AND TERTIARY ROCKS (MODERATE YIELDS TUBE-WELLS LIKELY)
CONSOLIDATED ROCKS (LOW TO MODERATE YIELDS FROM LARGE DIAMETER OPEN-WELLS TUBE-WELLS UNSUITABLE)

THE TERRITORIAL WATERS OF INDIA EXTEND INTO THE SEA TO A DISTANCE OF TWELVE NAUTICAL MILES MEASURED FROM THE APPROPRIATE BASE LINE.

POWER ECONOMY COMMITTEE

ANNEXURE VI

OUTLAY FOR RURAL ELECTRIFICATION AND TARGETS OF ENERGISATION OF ADDITIONAL PUMP SETS IN THE FOURTH FIVE YEAR PLAN

Sl. No.	State/Union Territory	No. of additional pumps likely to be energised during IV Plan	Outlay on rural electrification within State Plan during IV Plan (Rs. crores)
(1)	(2)	(3)	(4)
1	States	745,815	285.15
2	Andhra Pradesh	50,000	15.00
3	Assam	3,200	10.88
4	Bihar	89,000	36.00
5	Gujarat	15,000	6.00
6	Haryana	25,000	10.00[1]
7	Jammu & Kashmir	120	1.00
8	Kerala	11,250	4.50
9	Madhya Pradesh	50,000	20.00
10	Maharashtra	100,000	25.00
11	Mysore	38,670	15.50
12	Nagaland	Nil	0.07
13	Orissa	1,500	6.05
14	Punjab	22,500	9.00
15	Rajasthan	35,000	14.00
16	Tamil Nadu	152,165	41.15
17	Uttar Pradesh	150,000	61.00[2]
18	West Bengal	2,410	10.00
19	Union Territories	4,185	9.50
20	Andaman & Nicobar Islands	Nil	0.55
21	Chandigarh	195	Nil
22	Dadra and Nagar Haveli	Nil	0.30
23	Delhi	2,500	2.50
24	Goa, Daman & Diu	100	2.27
25	Himachal Pradesh	Nil	1.21
26	Lacadivi, Minicoy, Aminidivi Islands	Nil	0.18
27	Manipur	Nil	0.79
28	N.E.F.A.	Nil	1.40
29	Pondicherry	1,300	Nil
30	Tripura	90	0.30
31	Total (1+19)	750,000	294.65

---

[1] Targets corresponding to outlays in Col. 6.

[2] Tentative.

ANNEXURE VII

COST OF 11KV LINES PER K.M.

Sl. No.	Particulars	Andhra Pradesh		Assam	
		Quantity	Amount	Quantity	Amount
	I. Supports :				
1	Supports & Base Plates	13 Nos. RCC 8.23 Meters	2,080*	14 Nos. 28ft. RCC	2,170
2	Top hampers				
3	'V' Cross arm & channel arm	12 Nos.	228	10+2 Nos.	246
4	11 KV pin insulators complete	33	264	30 Nos.	210
5	11KV strain insulators complete	6	174	9 sets	207
6	Cement/Concrete/Muffing etc.	13 Nos. (Base concreting)	91	14 Nos.	70
7	Stay sets/stay wire etc.	8 sets	160	6 sets	280
8	Bracing sets	1 set	150		
	SUB-TOTAL (I)		3,147		3,183
	II. Conductors & Accessories :				
9	Conductor	3.06 km (0.03 CE)	2,938	3.06 km (0.04 CE)	3,672
10	Al. Binding wire, tapes, jointing sleeves etc.	L.S	90		
11	Armour rod protection ferrules etc.				
	SUB-TOTAL (II)		3,028		3,672
	III. Earthing :				
12	Earthing sets	LS	162	L.S	200
13	G.I. Wire				
	SUB-TOTAL (III)		162		200
	IV. Miscellaneous :				
14	Danger Board etc.	4 Nos.	40		
15	Back clamps	11 Nos.	33		
16	Anticlimbing devices				
17	Sundries like paints, petty items etc.	L.S.	110	LS.	200
18	Land survey, tree cutting compensation	L.S.	120		
	SUB-TOTAL (IV)		303		200
	TOTAL (I to IV)		6,640		7,255
	V. Overhead Charges :				
19	Labour	L.S.	800	L.S.	1,000
20	Transport	L.S.	350	L.S.	
21	Contingencies				
22	Storage				
	SUB-TOTAL (V)		1,150		1,000
	TOTAL (I to V)		7,800		8,255
	Add. Estt. T&P Supervision Audit & Accounts etc.	Add 13.3%	1,037	Add Nil	..
	GRAND TOTAL (Rounded off)		8,835		8,255

सत्यमेव जयते

---

*Converted from per mile cost to per Km cost.

ANNEXURE VII—*Contd.*

Sl. No.	Particulars	Bihar		Gujarat	
		Quantity	Amount	Quantity	Amount
	I. Supports :				
1	Supports and Base Plates	8 Nos. RCC 27 ft. 2 Nos. 60 lbs. rails	1,280 405	12 Nos. 28 ft. RCC 1 No. 9M.RSJ	1,320 210
2	Top hampers	10 Nos.	20	13 Nos.	58.50
3	'V' Cross arm & channel cross arm	10 Nos.	280	13 Nos.	301.00
4	11KV pin insulators complete	30 Nos.	240	39 Nos.	234.0
5	11 KV strain insulators complete	6 sets	180	6 Nos.	126.00
6	Cement/Concrete/Muffing etc.	2 Nos.	40	69 cft.	208.00
7	Stay sets/stay wire etc.	6 sets	120	6 Nos.	210.00
8	Bracing sets	1 set	40		
	SUB-TOTAL (I)	..	2,605	..	2,667.50
	II. Conductors & Accessories :				
9	Conductor	3.1 km(0.025CE)	2,030	3.15km(0.04CE)	3,276.00
10	Al. Binding wire, tapes, jointing sleeves etc.	..	..	L.S.	25.00
11	Armour rod protection ferrules etc.	..	..	..	..
	SUB-TOTAL (II)	..	2,030	..	3,301.00
	III. Earthing :				
12	Earthing sets	3 Nos.	110	4 Nos.	84.00
13	G.I. Wire	125 KM	310	105 Kg.	189.00
	SUB-TOTAL (III)	..	420	..	273.00
	IV. Miscellaneous :				
14	Danger Board etc.	..	..	3 Nos.	3.00
15	Back clamps	..	..	..	..
16	Anti climbing devices	..	..	3 Nos.	24.00
17	Sundries like paints petty items etc.	L.S.	100	..	22.28
18	Land survey, tree cutting compensation	..	..	L..S..	50.00
	SUB-TOTAL (IV)	..	100	..	99.28
	TOTAL (I to IV)	..	5,155	..	6,340.78
	V. Overhead Charges :				
19	Labour	L.S.	815	..	585.50
20	Transport	L.S.	315	..	..
21	Contingencies	3%	155	..	..
22	Storage	..	..	..	..
	SUB-TOTAL (V)	..	1,285	..	585.50
	TOTAL (I to V)	..	6,440	..	6,930
	Add. Estt. T&P Supervision Audit & A/cs etc.	Add 8%	515	Add 11.4%	791
	GRAND TOTAL(rounded off)	..	6,955	..	7,720

ANNEXURE VII—*Contd.*

Sl. No.	Particulars	Haryana		Kerala	
		Quantity	Amount	Quantity	Amount
	I. Supports :				
1	Supports and Base Plates	30 ft. RCC 14 Nos. 2 Nos. 90 lb 36 ft. rails	2,520 600	13 Nos. T.W. Poles	1,430.00
2	Top hampers	14 Nos.	70	29 Nos. top brackets 13 pole caps	85.50 7.00
3	'V' cross arm & channel cross arm	16 Nos.	400	20 Nos.	165.00
4	11 KV pin insulators complete	48 Nos.	630	27 Nos.	405.00
5	11 KV. strain insulators complete	6 Nos.	180	12 Sets(Tension sets)	480.00
6	Cement/Concrete/Muffing etc.	16 Nos.	460	..	..
7	Stay sets/stay wire etc.	12 Nos.	420	9 sets	202.50
8	Bracing sets	50 Kg.	50	L.S.	192.00
	SUB-TOTAL (I)	..	5,330	..	2,967.00
	II. Conductors & Accessories :				
9	Conductor	3.06 km (0.04CE)	3,672	3.15 km (0.06CE)	4,173.75
10	Al. Binding wire, tapes, jointing sleeves etc.	..	..	L.S.	45.03
11	Armour rod protection ferrules etc.	..	..	27 Nos.	189.00
	SUB-TOTAL (II)	..	3,672	..	4,407.78
	III. Earthing :				
12	Earthing sets	3 Nos.	75	2 Nos.	50.00
13	G.I. Wire	1.02 km.	552	..	..
	SUB-TOTAL (III)	..	330	..	50.00
	IV. Miscellaneous :				
14	Danger Board etc.	..	..	..	..
15	Back clamps	10 kg.	15	..	
16	Anticlimbing devices 200kg	20 kg.	40	20 kg.	22.00
17	Sundries like paints, petty items etc.	L.S.	373	L.S.	303.22
18	Land survey, tree cutting compensation	...	15	L.S.	475.00
	SUB-TOTAL (IV)	..	9443	..	800.22
	TOTAL (I to IV)	..	9,775	..	8,225.00
	VI. Overhead Charges :				
19	Labour	L.S.	1,725.04	L.S.	400.00
20	Transport	2.5%	244.37	L.S.	75.00
21	Contingencies	1%	97.75	..	..
22	Storage	2%	195.50	..	..
	SUB-TOTAL (V)	..	2,262.66	..	475.00
	TOTAL (I to V)	..	12,040	..	8,700
	Add Estt., T&P Supervision Audit & A/cs etc.	Add 8.5%	1,023	Add 10%	870
			13,065		9,570

सत्यमेव जयते

ANNEXURE VII—*Contd.*

Sl. No.	Particulars	Madhya Pradesh		Maharashtra	
		Quantity	Amount	Quantity	Amount
	I. Supporters :				
1	Supports and base plates	D.P. supports complete 8 Nos. 30 ft. RCC	710.00* 984.00	10 Nos. 9 MRSJ 2 Nos. 60 lb rails	1,300
2	Top hampers	8 Nos.	48.00	..	536
3	'V' Cross arm & channel cross arm	8 Ns.	176.00	35M Channel	244
4	11 KV pin insulators complete	24 Nos.	168.00	36 Nos.	324
5	11 KV strain insulators complete	(Costs for insulators etc. for D.P. structure included in cost for DP support complete given above).	..	12 Nos.	300
6	Cement/Concrete/Muffing etc.	..	..	677 kg.	127
7	Stay sets/stay wire etc.	..	..	6 sets	181
8	Bracing sets	..	..	..	..
	SUB-TOTAL (I)	..	2,086.00		3,012
	II. Conductors & Accessories :				
9	Conductor	3.1 km (6.04CE)	3,726.20	3.1 km.(0.03CE)	3,100
10	Al. Binding wire tapes, jointing sleeves etc.	3 Nos.	19.57	L.S.	41
11	Armour rod protection ferrules etc.	..	..	..	..
	SUB-TOTAL (II)	..	3,745.77	..	3,141
	III. Earthing :				
12	Earthing sets	8 Nos.* LS for DP	120.00 20.00*	14 sets	150
13	G.I. wire	..	..	15 kg.	26
	SUB-TOTAL (III)		140.00		176
	IV. Miscellaneous :				
14	Danger Board etc.	8 Nos. & for DP	16.00* 2.00	14 Nos.	28
15	Back clamps	..	..	..	..
16	Anti climbing devices	8 Nos. & for DP	40.00 6.00*	15 kg.	28
17	Sundries like Paints petty items etc.	L.S. for DP	83.45 12.00*	L.S.	43
18	Land survey, tree cutting compensation	..	..	..	..
	SUB-TOTAL (IV)		159.45		99
	TOTAL (I to IV)		6,131.22		6,428
	V. Overhead Charges				
19	Labour	..	..	..	..
20	Transport	..	..	L.S.	200
21	Contingencies	..	..	..	..
22	Storage	..	..	.. Add 15%	..
	SUB-TOTAL (V)				994
	TOTAL (I to V)				1,194
					7,622
	Add Estt. T&P, Supervision Audit & Actts. etc.	Add 40%	2,452.50		
	GRAND TOTAL (rounded off)		8,585		7,600

---

*Converted from per mile cost to per km. cost.

ANNEXURE VII—*Contd.*

Sl. No.	Particulars	Mysore		Orissa	
		Quantity	Amount	Quantity	Amount
	I. Supports :				
1	Supports & base plates	9 M long fabricated steel poles(11) Nos. D.P. structure 9M. rails	1,595.00	10Nos. 8M RS Joist	2,977.20
2	Top hampers	..	..	8 Nos.	17.60
3	V cross arms & channel cross arms	11 Nos.	199.87	8 Nos.	260.20
4	11 KV pin insulators complete	36 Nos.	309.60	27 Nos.	361.80
5	11 KV strain insulators complete	..	..	6 sets	213.00
6	Cement/concreting/muffing etc.	L.S.	167.18	135 cft.	202.50
7	Stay sets/stay wire etc.	10 sets	250.00	3 sets	175.50
8	Bracing set	..	..	1 set	60.00
	SUB-TOTAL (I)		3,119.65		4,267.80
	II. Conductors & Accessories :				
9	Conductor	3.09KM(0.03CE)	2,654.31	3.06KM(.035CE)	3,696.48
10	Al. binding wire tape jointing sleeves etc.	L.S.	40.00	..	..
11	Armour rods, ferrules etc.	..	..	..	..
	SUB-TOTAL (II)		2,694.31		3,696.48
	III. Earthing :				
12	Earthing sets	12 Nos.	240.00	10 sets	150.00
13	G.I. Wire	..	..	..	..
	SUB-TOTAL (III)		240.00		150.00
	IV. Miscellaneous :				
14	Danger board, number plate etc.	..	..	..	..
14	(A) 11KV GO Switch for sectionalising	..	..	..	..
15	Back clamps	..	..	..	..
16	Anti-climbing device	LS including Boards	120.00	10 Nos.	50.00
17	Sundries like paint, petty items etc.	L.S.	35.00	L.S.	197.76
18	Land survey, tree cutting, compensation	..	..	..	..
	SUB-TOTAL (IV)		155.00		247.76
	TOTAL (I to IV)		6,208.96		6,362.04
	V. Overhead Charges :				
19	Labour	L.S.(including storage)	629.00	L.S. }	798.00
20	Transport			L.S. }	
21	Contingencies	..	..	..	..
22	Storage	..	..	..	..
	SUB-TOTAL (V)		629.00		798.00
	TOTAL(I to V)		6,840.00		9,160.00
Add					
	Estt. T&P, Supervision, Audit A/c etc.	Add 17%	1163	Add 10%	916
	GRAND TOTAL (rounded off) (Per KM)		8,005		10,075

सत्यमेव जयते

ANNEXURE VII—*Contd.*

Sl. No.	Particulars	Punjab		Rajasthan (Per mile)	
		Quantity	Amount	Quantity	Amount
	I. Supports :				
1	Supports & base plates	8 Nos. 32 ft. RCC 2 Nos. 32ft. RCC for D.P.	1,360.00	16Nos. 27 ft. RSJ	2,080.00
2	Top hampers	..	..	14Nos.(100Kg. angleiron)	70.00
3	V cross arms & channel cross arms	9 Nos.	140.00	14 Nos.	4 30.00
4	11 KV pin insulators complete	27 Nos.	270.00	42 Nos.	420.00
5	11 KV strain insulators complete	6 sets	120.00	6 sets	150.00
6	Cement/concreting/muffing etc.	..	..	..	..
7	Stay sets/stay wire etc.	2 Nos.	80.00	8 Nos.	272.00
8	Bracing set	1 No.	20.00	..	..
	SUB-TOTAL (I)		2,330.00		**3,422.00
					2,139.00
	II. Conductors & Accessories :				
9	Conductor	3.06 KM(0.04CE)	3,060.00	3.1 mile(0.03CE)	4,340.00
10	Al. binding wire tape Jointing sleeves	L.S.	30.00	10 Kg.	70.00
11	Armour rods, ferrules etc.	..	..	..	..
					**4,410.00
	SUB-TOTAL (II)		3,090.00		2,755.00
	III. Earthing				
12	Earthing sets	10 Nos.	300.00	5 sets	350.00
13	G.I. Wire	..	..	8 SWG 0.2 MT.	376.80
					726.80**
	SUB-TOTAL(III)		300.00		454.00
	IV. Miscellaneous :				
14	Danger board, number plate, etc.		..	8 Nos.	12
14(A)	11 KV GO switch for sectionalising	1 No	500.00	..	..
15	Back clamps	..	..	100kg.	80
16	Anti-climbing device	..	..	..	..
17	Sundries like paint, petty items etc.	L.S.	140.00	L.S.	190
18	Land survey, tree cutting, compenastion	..	..	..	..
					282**
	SUB-TOTAL (IV)		640.00		177
					8,840**
	TOTAL (I to IV)		6,360.00		5,525.00
	V. Overhead Charges :				
19	Labour	L.S.	741.55	15%	
20	Transport	L.S.	40.80		
21	Contingencies	1%	63.60	3%	..
22	Storage	1%	63.60	5%	
	SUB-TOTAL (V)		909.55		
	TOTAL (I to V)		7,300.00		
Add					
	Estt. T&P, Supervision Audit A/c etc.	Add 10%	730	2+8 Total 33%	1,990
	GRAND TOTAL (rounded off) (per KM)		8,030		7,517
				say	7,460

**Cost per mile.

ANNEXURE VII—*Contd.*

Sl. No.	Particulars	Tamil Nadu		U.P.		West Bengal	
		Quantity	Amount	Quantity	Amount	Quantity	Amount
1	2	3	4	5	6	7	8
	I. Supports :						
1	Supports & base plates .	14, 30ft.RCC	1750.00	8Nos. 60lb. rails 9M. long	1,800.00	20Nos. (26'—30' wood pole) M.S.Channel for D.P. Structure 10M.	1,683·20 56·20
2	Top hampers . . .	12Nos. 1 No. (DP)	49.20	8 Nos. F bracket	24.00	MS angle 20M top adopter	145,60
3	V cross arms & channel cross arms.	12 Nos. 1 No. (DP)	180.00 65.00	8 Nos. Sal Wood cross arms complete.	80.00	17 Nos.	92.99
4	11 KV pin insulators complete.	36 Nos.	237.60	24 Nos.	168.00	52 Nos.	604.24
5	11KV strain insulators complete.	6 sets	146.10	..	..	12 Nos.	289.92
6	Cement/concreting/muffing etc.	L.S.	105.00	8 Nos. stone pads	16.00	322 cft.	383.00
7	Stay sets/stay wire . .	6 sets	106.80	L.S.	30.00	12 sets	234.60
8	Bracing set . . .	1 set	95.00	..	..	Wooden 34Nos. MSA 20M.	48.96 97.60
							**3,636.31
	SUB-TOTAL (I) . . .		2,734.70		2,118.00		2,272.00
	II. Conductors & Accessories :						
9	Conductor . . .	3.06 Km (0.03CE)	2,157.30	3.09 Km (0.04CE)	3,090.00	5 Km(0.05CE)	5,760.00
10	Al. binding wire tape jointing sleeves.	..	..	L.S.	42.00	10kg	69.30
11	Armour rods, ferrules etc.	..	..	24 Nos.	108.00	..	..
							**5,829.30
	SUB-TOTAL (II) . .		2,157.30		3,240.00		3,643.00
	III. Earthing :						
12	Earthing sets . . .	LS. included in S. No. 6	..	3 sets	60.00	..	..
13	G.I. Wire . . .	..	..	7/16SWG(127kg)	254.00	..	..
	SUB-TOTAL (III) . .				314.00		
	IV. Miscellaneous :						
14	Danger board, Number plate, etc.	..	..	..	..	..	..
14(A)	11KV GO Switch for sectionalising.	..	..	6 Nos.	36.00	10 Nos.	25.00
15	Back clamps . . .	..	..	..	..	..	..
16	Anti-climbing device .	..	..	10kg	20.00	..	..
17	Sundries like paint, petty items, etc.	L.S.	118.00	8 Nos. Earth-wire clips	8.00	L.S.(Reduced from Rs. 280 to bring total tally.)	160.00
18	Land survey, tree cutting compensation .	..	..	..	..	..	..
							185.00**
	SUB-TOTAL (IV) . .		118.00		64.00		116.00
	TOTAL (I to IV) . .		5,010.00				9,650.00 **
							6,031.00

**Cost per mile.

ANNEXURE VII—*Concld.*

Sl. No.	Particulars	Tamil Nadu		U.P.		West Bengal	
		Quantity	Amount	Quantity	Amount	Quantity	Amount
1	2	3	4	5	6	7	8
	V. Overhead Charges :						
19	Labour	L.S.	740.00	L.S.	300	L.S.	2,500.00
20	Transport . . .	L.S.		L.S.	250	..	
21	Contingencies . . .	..	..	..	..	..	..
22	Storage	..	..	..	..	15%	1,447.00
	SUB-TOTAL (V)		740.00		550		3,947.00 2,467.00
	TOTAL(I to V) . .		5,750.00		6,300		13,597.00** 8,500.00
Add							
	Estt. T&P, Supervision, Audit A/c etc.	Add 10%	575	Add 16%	1,008	Add L.S.	890.00
							14,487.00**
	GRAND TOTAL (rounded off) (Per KM)		6,325.00		7,310.00		9,000.00

**Cost per mile.

सत्यमेव जयते

ANNEXURE VIII

11/0.4 KV, 100 KVA TRANSFORMER SUB-STATION

(*Pro-forma obtained from R.E.C.*)

Sl. No.		Andhra Pradesh		Assam	
		Qty.	Amount	Qty.	Amount
	I. *D. P. Structure*				
1	Supports complete with . .	..	1,150.00	2 Nos. 20 ft. RCC pole with steelcross arms.	370.00
2	Cross arms etc.	..	..	..	..
3	11 KV pin insulators	..	..	..	..
4	11 KV strain insulators . . .	..	..	..	..
5	Bracings	..	..	..	..
6	Concreting	..	..	L. S.	180·00
7	Stay set & stay wire	..	..	2 sets	94·00
8	Anticlimbing devices danger boards etc.	..	..	L. S.	200·00
	II. *Transformer*				
9	11/0·4 KV, 100 KVA	1 Nos.	7,700·00	1 Nos.	7,550·000
	III. *Switchgear*				
10	11 KV G.O. Switch	1 Nos.	500·00	1 Set	450·00
11	11 KV H. G. Fuses	1 set	500·00	1 set	230·00
12	L. T. Distribution set	1 No.	1,000·00	L. S.	500·00
13	Lightning arresters—				
	(a) H.T.	1 set	465·00	1 set	400·00
	(b) L.T.	1 set	84·00	..	..
	IV. *Earthing*				
14	Earthing set & earthing Clamps . .	..	..	L. S.	200·00
	V. *Petty items*				
15	Sundries etc.	..	..	L. S.	100·00
	SUB-TOTAL (item 1 to 15) .		11,399·00		10,274·00
	VI. *Overhead charges*				
16	Labour	L.S.	600·00	L.S.	250·00
17	Transport	..	..	..	..
18	Storage	..	..	..	..
19	Contingencies Sub-total (V) rounded off .		600·00		250·00
	total (item 1 to 19) . . .		12,000·00		10,530·00
20	Estt. others (T&P) Supervision, Audit & A/cs Add etc.		1,485·00		Nil
	GRAND TOTAL		13,485·00		10,530·00

ANNEXURE VIII—*Contd.*

11/0.4 KV—100 KVA TRANSFORMER SUB-STATION

Sl. No.		Bihar		Gujarat		Haryana	
		Qty.	Amount	Qty.	Amount	Qty.	Amount
	I. *D. P. Structure*						
1	Supports Complete with	2 pole-structure complete	1,000.00	2 No. 9 M. R. S. joists with steel structure :	820	2 No. MS rails 90 lb and channel iron for cross arms etc	735.00
2	Cross arms etc.	..	..	..	..	..	..
3	11 KV pin insulators	..	..	..	..	6 Nos.	180.00
4	11 KV strain insulators	..	..	..	..	..	..
5	Bracing	..	..	..	..	..	..
6	Concreting	..	..	75 cft	224.00	L S	40.00
7	Stay set and stay wire	..	..	4 Nos.	140.00	4 Nos.	140.00
8	Anticlimbing device danger boards etc.	..	..	2 Nos.	18.00	L.S.	13.00
	II. *Transformer*						
9	11/0.4 KV. 100 kVA	1 Nos.	7,500.00	1 Nos.	6,050.00	1 No.	6,125.00
	III *Switchgear*						
10	11 KV G.O. Switch	1 set	500.00	..	..	1 No	350.00
11	11 KV H.G. Fuses	1 set	200.00	3 Nos.	435.00	..	..
12	L.T. Distribution set	L S	1,200.00	L S	1755.00	1 No.	520.00
13	Lightning Arresters	1 set	750.00	3 Nos.	420.00	1 No.	600.00
	(a) H.T.	..	..	..	..	..	..
	(b) L T	..	..	3 Nos.	105.00	..	..
	IV. *Earthing*						
14	Earthing set and earthing clamps.	L.S.	60.00	2 Nos.	60.00	L.S.	330.00
	V. *Petty items*						
15	Sundries etc.	L.S.	50.00	..	..	L.S.	524.00
	SUB-TOTAL item (1 to 15)		11,260.00		10,027.00		9,557.00
	VI. *Overhead charges*						
16	Labour	L.S.	300.00	L.S.	300.00	L.S.	383.50
17	Transport		L.S.	150.00		2.5%	238.92
18	Storage	..	..	..	..	2%	191.14
19	Contingencies	3%	337.80			1%	95.57
	SUB-TOTAL (VI)		787.80		300.00		909.13
	ROUNDED OFF TOTAL (item 1 to 19)		12,00.000	10,350.00	10,350.00		10,466.00
20	Estt. others (T&P) Supervision, Audit & Ac/s etc.	Add 8%	960.00	Add 11.4%	1,180.00	Add 8.5%	890.00
	GRAND TOTAL		12,960.00		11,530.00		11,355.00

ANNEXURE VIII—*Contd.*

11/0.4 KV, 100 KVA TRANSFORMER SUB-STATION

Sl. No.		Kerala		Madhya Pradesh		Maharashtra	
		Qty.	Amount	Qty.	Amount	Qty.	Amount
	I. *D. P. Structure*						
1	Supports complete with	2 Nos. T W. poles with cross arms etc.	252.50	2 Nos. 60 lbs. rails with cross arms etc.	1,110.00	2 Nos. rails 60 lbs/yard with MS angle cross arms.	1,323.00
2	Cross arms etc.	..	..	..	..	..	..
3	11 KV pin insulators	3 Nos.	45.00	3 Nos.	21.00	6 Nos.	54.00
4	11 KV strain insulators	..	..	3 Nos.	60.00	6 Nos.	150.00
5	Bracings	..	..	..	..	100 no. L.T. Shackles	20.00
6	Concreting	..	..	L.S.	180.00	L.S.	25.00
7	Stay set & stay wire	..	..	6 Nos.	180.00	6 sets	164.00
8	Anticlimbing devices danger boards etc	L.S.	20.00	..	..	30 Kg	56.00
	II. *Transformer*						
9	11/0.4 KV, 100 KVA	1 No.	7,650.00	1 No.	7,345.00	1 No.	7,500.00
	III. *Switchgear*						
10	11 KV G.O. Switch	1 set	660.00	..	..	..	..
11	11 KV H.G. Fuses	3 Nos.	240.00	3 Nos.	345.00	1 set	300.00
12	L.T. Distribution set	L.S.	104.00	1 No.	1,372.74	1 No.	700.00
13	Lightning arresters	1 set	480.00	1 set	405.00	1 set	720.00
	(a) H T	..	..	..	..	..	..
	(b) L T	..	..	..	..	..	..
	IV. *Earthing*						
14	Earthing set & earthing clamps	3 Nos.	105.00	L.S.	30.00	1 set	20.00
	V. *Petty items*						
15	Sundries etc	L.S.	198.80	L.S.	155.00	L.S.	40.00
	SUB-TOTAL (item 1 to 15)		9,775.00		11,203.74		11,072.00
	VI. *Overhead charges*						
16	Labour	L.S.	100.00	14%		15%	1,690.00
17	Transport	L.S.	25.00			L.S.	200.00
18	Storage	..	..	7%	..	..	..
19	Contingencies	..	..	5%	..	..	..
	SUB-TOTAL (VI)	..	125.00	..	..	..	1,890.00
	ROUNDED OFF TOTAL (itme 1 to 19)		9,900.00				13,000.00
20	Estt other (T&P) Supervision, Audit & A/cs etc	Add 10%	990.00	14%	4,481.60	*Included in item (16)	
	GRAND TOTAL		10,890.00	40%	15,685.00		13,000.00

ANNEXURE VIII—*Contd.*

11/0.4 kV—100 kVA Transformers Substation

Sl. No.		Mysore		Orissa	
		Qty.	Amount	Qty.	Amount
	I. *D. P. Structure*				
1	Supports complete wtih	2 poles structure complete with 9MRSJ	648.00	Complete (L.S.)	711.00
2	Cross arms etc.	..	..	..	..
3	11 kV pin insulators	3 Nos.	25.80	..	..
4	11 kV train insulators . .	2 Nos.	56.40	..	..
5	Bracing	..	..	..	..
6	Concreting	L.S.	26.18	..	..
7	Stay sets and stay wire	4 sets	100.00	..	..
8	Anticlimbing device danger boards etc. .	L.S.	34.00	..	..
	II. *Transformer*				
9	11/0.4 kV, 100 kVA	1 No.	8,500.00	1 No.	6,825.00
	III. *Switchgear*				
10	11 kV G.O. Switch	1 set	372.00	1 No.	525.00
11	11 kV. H.G. Fuses	1 set	100.00	..	..
12	L. T. Distribution set	1 No.	775.00	1 No.	462.50
13	Lightning Arresters	3 Nos.	555.00	1 set	472.50
	(a) H.T.	..	..	..	..
	(b) L.T.	..	..	1 set	169.35
	IV. *Earthing*				
14	Earthing set and earthing clamps . .	3 sets	110.70	L.S. (includes cable also.)	500.00
	V. *Petty items*				
15	Sundries etc.	L.S.	49.72	..	..
	Sub-total (1 to 15) . . .		11,352.80		9,665.35
	VI. *Overhead charges*				
16	Labour	L.S.	557.20	L.S.	250.00
17	Transport	..	..	..	..
18	Storage	..	..	..	..
19	Contingencies Sub-total(VI) . . .	..	..	..	..
	Rounded off total (item 1 to 19) .		11,910.00		9,920.00
20	Estt.others(T&P)Supervision, Audit & A/cs	Add 17%	2,025.00	Add 10%	990.00
	Grand Total		13,935.00		10,910.00

सत्यमेव जयते

ANNEXURE VIII—*Contd.*

11/0.4 kV —100 KVA Transformers Substation

Sl. No.		Punjab		Rajasthan		Tamil Nadu	
		Qty.	Amount	Qty.	Amount	Qty.	Amount
	I. *D. P. Structure*						
1	Supports complete with	2 Nos RCC	340.00	2 Pole structure with channel iron etc.	600.00	2 Pole 9.15 M RCC (Complete)	530.00
2	Cross arms etc	..	..	..	..	..	..
3	11 kV pin insulators	..	..	3 Nos.	30.00	..	..
4	11 kV strain insulators	3 Nos.	60.00	3 Nos.	75.00	..	..
5	Braching	..	..	..	..	L S (Concreting & earthing)	110.00
6	Concreting	..	..	..	..	L S	35.60
7	Stay sets and stay wire	2 sets	60.00	4 Nos.	128.00	..	..
8	Anticlimbing device danger boards etc.	..	..	L.S.	9.51	..	..
	II. *Transformer*						
9	11/0.4 kV, 100 kVA	1 No.	5,500.00	1 No.	7,000.00	1 No	6,300.00
	III. *Switchgear*						
10	11 kV G.O. Switch	1 No.	400.00	1 No.	600.00	1 set	660.00
11	11 kV H.G. Fuses	1 No. ord.	100.00	1 set	250.00	1 set	110.00
12	L. T. Distribution set	1 No.	350.00	1 No.	500.00	1 No	700.00
13	Lightning Arresters	set on all s/s	150.00	1 No.	500.00	1 set	620.00
	(a) HT.	..	..	..	..	..	..
	(b) LT.	..	..	..	..	1 set ..	140.00
	IV. *Earthing*						
14	Earthing set and earthing clamps	2 Nos.	80.00	1 set	400.00	L.S.	150.00
	V. *Petty items*						
15	Sundries etc.	L S	20.00	L.S.	62.63	L.S.	79.40
	Sub-total (item 1 to 15)		7,060 .00		9,655.14		9,435.00
	VI. *Overhead charges*						
16	Labour	L S	298.14	13%	..	L.S.	145.00
17	Transport	L S	50.00		1,318.72	..	..
18	Storage	1%	71.00		289.65	..	..
19	Contingencies	1%	71.00	3% plus2 %(T&P)	189.90	..	..
	Sub-total (VI)		490.14		1,798.27		145.00
	Rounded off total (item 1 to 19)		7,550.00		11,460.00		9,580.00
20	Estt. others (T&P) Supervision, audit & Ac/s.	Add 10%	755	Add 8%	916.00	Add 10%	960.00
	Grand Total		8,305.00		12,400.00		10,540.00

ANNEXURE VIII—*Concld.*

11/0. kV—100 KVA Transformers Substation

Sl. No.		Uttar Pradesh		West Bengal	
		Qty.	Amount	Qty.	Amount
	I. *D. P. Structure*				
1	Supports complete with	2 Pole structure	950.00	2 Nos. 90 lb. rails with M. S. Angle iron cross arms etc.	901.52
2	Cross arms etc.	..	..	..	..
3	11 KV. pin insulators	3 Nos.	21.00	..	..
4	11 kV strain insulators	3 Nos.	66.00	..	..
5	Bracing	..	..	..	..
6	Concreting	..	..	L. S.	150.00
7	Stay sets and stay wire	2 Nos.	70.00	4 sets	110.20
8	Anticlimbingdevicedanger boards etc.	L. S. (including sundries).	1,100.00	L.S.	18.96
	II. *Transformer*				
9	11/0.4 kV, 100 kVA	1 No.	6,000.00	1 No.	6,250.00
	III. *Switchgear*				
10	11 kV G.O. Switch	1 set	170.00	1 No.	452.00
11	11 kV H. G. Fuses	1 No.	575.00	L.S.	100.00
12	L.T. Distribution set	1 No.	2,150.00	1 No.	1,388.51
13	Lightning Arresters	1 set	200.00	3 Nos.	690.00
	(a) H.T.	..	..	..	..
	(b) L.T.	..	..	..	..
	IV. *Earthing*				
14	Earting set and earthing clamps	L.S.	100.00	L.S.	320.92
	V. *Petty items*				
15	Sundries etc.	..	..	L.S.	339.60
	Sub-total (item 1 to 15)		11,402.00		10,721.71
	VI. *Overhead charges*				
16	Labour	L.S.	600.00	L.S.	950.00
17	Transport	..	..	..	..
18	Storage	..	..	..	..
19	Contingencies	..	..	..	..
	Sub-total (VI)		600.00	..	950.00
	Rounded off total (item 1 to 19)		12,000.00		11,671.00
20	Estt. others(T&P)Supervision, Audit & A/cs	Add 16%	1,920.00	Add L.S.	900.00
	Grand Total		13,920.00		12,571.00
				Say	13,000.00

सत्यमेव जयते

ANNEXURE IX

TARIFF FOR AGRICULTURAL CONSUMERS IN VARIOUS STATES WITH 5 HP OR 10 HP CONNECTED LOAD @ 15% L.F.

Board/Union Territory	AGRICULTURAL				
	Average rate in P/kWh@	Electricity duty P/kWh	Total	Minimum power consumption Guarantee	Tariff in force from
Andhra Pradesh	10·45	..	10·45	Rs. 50·00 per H.P. of contracted load per year.	1-9-67
Assam	14·00	1·00	15·00	Rs. 4·00 per kW of connected load per month.	1-3-65
Bihar	18·00	1·00	19·00	NIL	1-8-70
Gujarat	15·21	1·20	16·41	Rs.35·00/B.H.P.per year	1-1-70
Haryana	16·84	..	16·84	Rs.75·00perB.H.P.per year	1-8-69
Kerala	9·00	0·90	9·90	Rs. 5·00 per month	1-1-70
Madhya Pradesh	13·00	..	13·00	260 units/year BHP or part thereof the installed capacity.	1-6-69
Maharashtra	18·00**	..	18·00	Rs. 40·00 per BHP/year	1-10-69
Mysore	10·00£	1·00	11·00	Rs. 48* BHP/year	1-4-66£ 14-4-69*
Orissa—					
(a) Hydel	10·00	1·50	11·50	Rs. 24·00 per BHP/year	1-8-66
(b) Diesel	22·00	3·30	25·30	Rs. 5·00 per BHP/month	1-8-51
Punjab	9·79@ (10 H.P.) 8·57@ (5 H.P.)	..	9·79	Un-metered supply with variable block rate depending on installed capacity.	1-7-68
Rajasthan—					
(a) Hydro (b) Steam (c) Diesel	13·30	..	13·30	Rs. 42·00 per BHP /year	1-8-66
Tamil Nadu	10·00	2·00	12·00	Rs. 17·50 per HP/year	1-1-70
Uttar Pradesh	15·00	..	15·00	Rs.110·00 per BHP/year from 1-7-69 Rs. 120·00 BHP/year from 1-7-1970	1-7-68
West Bengal	12·00	1·00	13·00	Rs.18·00/HP/year upto 5 H.P. Rs. 36·00/HP/year above 5 H.P. of installed capacity.	31-8-56
Andaman & Nicobar	31·00	..	31·00	Rs. 2·00 per BHP/month	19-9-60
Dadra and Nagar Haveli	19·25	..	19·25	Rs. 70·00/BHP/year	1-7-65
Delhi	11·52	1·00	12·52	Rs. 4·00 per kW/month	1-4-68
Goa, Daman and Diu	14·00	..	14·00	Rs.36·00per year/HP subject to a minimum of 2 H.P.	1-8-68
Himachal Pradesh	9·61	..	9·61	Rs. 0·50 /H.P./month	1-8-67
Lacadives	40·00	..	40·00	..	13-9-62
Manipur	25·00	..	25·00	Rs. 5.·00 per H.P./month	1-7-64
Pondicherry	9·49	..	9·49	Rs.17·50HP connected per year	1-12-68
Tripura —					
(a) Agartala	25·00 (10 HP)	..	25·00	Rs. 2·00 per HP/month	16-9-67
	28·00 (5 H.P.)	..	28·00		
(b) Rest	37·00	..	37·00	Rs. 1·00 per HP/month	16-9-67

@The average rate for 5 HP and 10 HP agricultural load is the same except otherwise stated.

**A rebate of 2 P/kWh shall be given for the first two years in the case of new agricultural consumers.

SOURCE:—CW&PC.

ANNEXURE X

TARIFF FOR SMALL INDUSTRIAL CONSUMERS IN VARIOUS STATES WITH 10 HP. CONNECTED LOAD @ 15% L.F.

Board/Union Territories	SMALL INDUSTRIES				
	Average rate in P/kwh	Electricity duty P/kwh	Total	Minimum power consumption Guaranteed	Tariff force from
Andhra Pradesh	21·22	..	21·22	Rs. 5·00 per H.P./month	1-5-67
Assam	16·00	1·00	17·00	Rs. 4·00 per kW/month	1-3-65
Bihar	20·00	1·00	21·00	Rs. 10·00 per kVA installed	1-8-70
Gujarat	16·90	1·60	18·50	Rs. 6·00 per BHP/month	1-1-70
Haryana	12·96	1·94	14·90	Rs. 5·00 per kW/month	1-3-69
Kerala	14·40	1·20	15·60	Rs. 3·00 per kW/month	1-6-68
Madhya Pradesh	15·50	1·00	16·50	30 units/month/BHP or part thereof of installed capacity.	1-6-69
Maharashtra	18·00	1·00	19·00	Rs. 4·95 per month/BHP	1-10-69
Mysore	11·00	1·50	12·50	Rs. 5·00 per B.H.P./month	14-4-69
Orissa—					
(a) Hydro	12·00	1·80	13·80	Rs. 6·0 per kW/month or Rs. 4·50 per HP/per month	1-8-66
(b) Diesel	22·00	3·30	25·30	Rs. 5·00 per BHP/month	1-8-51
Punjab	10·80	1·62	12·42	Rs. 2·50 per month per kW of connected load.	1-4-66
Rajasthan:—					
(a) Hydro (b) Steam	14·53	1·00	15·53	30 kwh consumption/BHP	1-8-66
(c) Diesel	28·90	1·00	29·90	Rs. 84·00 per BHP/year	1-8-66
Tamil Nadu	13·80	2·40	16·20	Rs. 2·50 per HP/month	1-1-67
Uttar Pradesh	18·00	3·60	24·60	Rs. 120·00 BHP/year of contracted load	1-7-68
West Bengal	15·00	1·50	16·50	Rs. 36·00 per HP/year	31-8-65
Andaman & Nicobar	31·00	..	31·00	Rs. 2·00 per BHP/month	19-9-60
Dadra & Nagar Haveli	19·25	..	19·25	Rs. 70·00 per BHP/year	1-7-65
Delhi	11·52	1·00	12·52	Rs. 4·00 per kW/month	1-4-68
Goa, Daman & Diu	16·00	..	16·00	Rs. 5·00 per kva or part thereof (Rs. 60·00 per kVA/year for seasonal loads).	1-8-68
Himachal Pradesh	10·62	..	10·62	..	1-8-67
Laccadives, Minicoy Islands Kavarathi Laccadives.	40·00	..	40·00	..	13-9-62
Manipur	25·00	..	25·00	Rs. 5·00 per HP/month	1-7-64
Pondicherry	14·40	..	14·40	Rs. 2·50 per month/HP	1-12-68
Tripura:—					
(a) Agartala	25·00	..	25·00	Rs. 2·00 per HP/month	16-9-67
	(10 HP) 28·00	..	28·00		
(b) Rest	(5 H.P.) 37·00	..	37·00	Rs. 1·00 per HP/month	16-9-67

SOURCE : CW&PC

ANNEXURE XI

COMPARISON OF AVERAGE ELECTRICITY RATES FOR AGRICULTURE IN VARIOUS COUNTRIES

(Based on average annual revenue per KWH sold in 1968)

(All figures in paise)

Serial No.	Country	Average Electricity rate
1	Japan	8·63
2	Korea	8·25
3	Malaysia	
	(a) Saban	29·48
	(b) Sarawak	77·78
4	New Zealand	14·85
5	India	10·51
6	U. K.	15·32

Source :— For serial No. 1 to 4 : U. N. Economic Commission for Asia and Far East.
For Serial No. 5 : CWPC (PW).
For Serial No. 6 : The Electricity Council's Annual Report and Accounts 1967-68 (Statement A5).

सत्यमेव जयते

APPENDIX

सत्यमेव जयते

KERALA STATE ELECTRICITY BOARD

PART I

Questionnaire regarding rural Electrification in the States	Reply to the Questionnaire
1	2
1. Average distance to consumer's well from the L.T. Line in electrified village.	1. Well irrigation in general is rare in this State. Agricultural pump sets are mostly installed on the banks of rivers. The distances of the pump house in these cases from the nearby L.T. lines vary widely and an average cannot therefore be furnished.
2. Average distance to a village proposed to be electrified from the existing H.T. lines upto 33 KV.	2. Here, H. T. lines are mainly 11 KV Average distance of the H. T. line from the village selected or electrification vary Roughly it can be taken as 5 to 7 KM.
3. Estimated expenditure of laying H.T. line per KM.	3. Cost of constructing 11 KV line with T. W. poles and A.C.S.R. (Mink) is Rs. 8,700·00 per KM.
4. Estimate expenditure for laying L.T. line per KM.	4. (i) Cost of constructing 3 phase line with AAC on TW/RCC. pole is Rs. 7,860·00 per KM. (ii) Cost of constructing single phase line Rs. 5,325·00 per KM.
5. Approximate number of consumers to be served form the Transformer in any village and transformer size.	5. This depends on the loads coming up in each village. In some villages the load will be mainly domestic. In some others the loads may be mainly agricultural. The approximate number of consumers served from each transformer cannot be stated as it is varying, with the localities. Transformers of capacities 50 KVA (3 phase) and above are mostly used in rural electrification,
6. What should be load factor in case of agricultural connection for preparation of estimates.	6. No minimum load factor is prescribed for agricultural services. For an agricultural service a minimum of Rs. 5/— is charged per meter per month. When supply cannot be effected from the existing lines the consumer is asked to guarantee a minimum revenue return equal to 10% of the capitalised cost for such extension necessary.
7. What is the yard-stick for sanctioning different categories of line staff in Rural Areas for proper maintenance.	7. The following yard stick has been recently approved by the Board. A. L.T. distribution and maintenance. (i) For every 300 consumers with 5 to 10 miles distribution lines:— One Lineman or one 2nd Grade Overseer, One Asst. Lineman and One Line Helper. (ii) For every 150 street lights: One Asstt. Lineman or One Line Helper. (iii) For every three Lineman : One First Grade Overseer. All distribution within five miles radius of one centre will be considered as one unit. B. 11 *K V. Distribution* (i) For the first 30 miles of 11 kV line : One Lineman, One Asstt. Lineman. (ii) For every additional 15 miles of 11 kV line : One Lineman. These staff attend to regular maintenance and also supervise small construction works like line extensions, service connections and installation of street lights. Special construction sections with one Junior Engineer and one First Grade Overseer for each section are sanctioned for carrying out major 11 kV line extensions or rural electrification works.
8. What is the procedure for attending fuse calls and maintenance in Rural Areas?	8. There is no special procedure, Lineman or line Helper in charge of the rural centre attend to fuse-off calls and routine maintenance, engaging muster roll workers also, if required.

PART I—*Contd.*

1	2
9. Whether the internal installations of agricultural connection including pumps and motors are maintained departmentally or by the consumer him-self.	9. Internal installations of agricultural connections are maintained by the consumers themselves.
10. What facility has been allowed to the agricultural consumers for utilising the motor of the pumping set for use other than irrigation? Is use of the agricultural pumping connection for other purposes such as farm lighting and other appliances etc. permitted?	10. Agricultural consumers can utilise their motors for indust purposes also, when the pumps cannot be put into operation for agricultural purposes and the energy consumed during such periods will be charged at the appropriate tariff. This combined working of motor will have to be approved by the local officers of the Board. In case the motor is being used for both agricultural and industrial purposes without any seasonal restrictions, the consumer will have to opt the industrial tariff.

PART II

Questionnaire regarding rural Electrification in the States 1	Reply to the Questionnaire 2
1. Electricity consumed per pumpset H.P. per year? .	1. Per KW of agricultural connected load the consumption for 1968-69 was 594 kwh and that for 1967-68 was 622 units.
2. Annual cost per acre per crop for electric pumping for different crops.	2. These details are not available with this Board.
3. Net return per pump-set (after taking into account transmission losses and other over-heads).	3. The average return per KW of connected load for the yea 1968-69 was Rs. 56·50.
4 What is the system of meter reading, billing and collection of energy charges in the rural areas?	4. Meter reading, billing and collection of energy charges are made monthly, in rural and urban areas.
5. What other types of Agricultural processing machineries are permissibl under the agricultural tariff and upto load?	5. No other type of agricultural processing machinery is allowed under agricultural tariff.
6. At what rate electricity is supplied in Villages for street lights ?	6. The installation, maintenance and replacement of bulbs of streetlights are done by this Board. Based on the wattage of bulb and burning hours the tariff for street lights is fixed. Annual charges are given below:—

The figures given are in rupees and are for one year :—

Burning hrs.		4	5	8	10	12 hours
	W	Rs.	Rs.	Rs.	Rs.	Rs.
1 Metal filament lamp	25	15	20	24	28	32
2 Metal filament lamp	40	22	29	34	41	47
3 Metal filament lamp	60	28	39	47	56	65
4 Metal filament lamp	100	40	57	69	84	98
5 Metal filament lamp	150	56	79	100	120	141
6 Metal filament lamp	200	74	107	134	162	190
7 Metal filament lamp	1,000	386	547	686	812	945
8 Mercury Vapour lamp	80	77	108	135	162	190
9 Mercury Vapour lamp	125	154	210	229	248	267
10 Mercury Vapour lamp	250	212	289	320	349	377
11 Mercury Vapour lamp	400	277	385	439	494	548
12 Mercury Vapour lamp Blended type . .	160	138	197	252	306	362
13 Sodium Vapour lamp	150	162	222	277	332	388
14 Fluorescent lamp	40	74	84	92	102	111
15 Fluorescent lamp.	80	108	129	149		184
16 Fluorescent lamp.	160	149	186	218	50	281

PART II—*Contd.*

1	2
7. What is the break-up of financial assistance if any, received from different Financial Institutions for Rural Electrification Scheme for the year 1966-67 and onwards?	7. Except for the loan assistance from the State Government no financial assistance was received from different financial institutions for rural Electrification Scheme. Loan assistance received from Government for 1966-67 Rs. 60 lakhs. 1967-68— 1968-69 Rs. 143 lakhs. 1969-70—
8. What was their conditions of repayment of loans and interest charges?	8. State Loans are repayable in 20 annual equal instalments of both principal and interest, commencing from the 6th anniversary of the drawal of the loan. During the first 5 years interest will be payable. The rate of interest is 6·25% and penal interest at 2·5% if payment is not made on or before the due date. Loans were also received from the Government through the N.E.S. Block development Funds. This is payable in 12 equal instalments of both principal and interest after one year from the date on which the amount is transferred to the Board. The interest rate is 5·5 %.

STUDY GROUP ON RURAL ELECTRIFICATION—POWER ECONOMY COMMITTEE

Supplementary Questionnaire	Reply to the Questionnaire
1	2
1. What are the criteria used in the planning of energisation if IP sets and village electrification in the Plan periods and the annual Plans? Is it on the basis of existing wells in the State or on a predetermined number comprising the existing well and those that may come up during the course of the Plan periods?	1. Well irrigation pump sets are comparatively few in this State Most of the lift irrigation schemes are located on the banks of rivers involving pumpsets of capacities 25 to 300 H.P. Dewatering Kayal lands and water-logged areas are the other types of irrigation loads where big pumpsets are employed Power supply to these major schemes is arranged at the request of Irrigation Department. In the formulation of Rural Electrification programme, village having scope for agricultural pumpsets are given priority. There is no special programme for power supply to well irrigation pumpsets.
2. Whether the vicinity of the wells to the existing distribution lines would form an important basis or irrespective of existence of the lines wells are chosen on the demand of the agriculturists?	2. Demands of agriculturist for power supply are considered irrespective of the vicinity of the existing distribution system to the wells.
3. Is the selection of wells made in consultation with other Departments such as the Revenue Department etc.? If so, the procedure adopted may be briefly indicated.	3. So far there has been no integrated approach for selection of agricultural schemes and giving power supply. Requests were being considered whenever individual representation or applications from Irrigation Department were received. Recently the Irrigation Department, Agricultural Department and Agro Industries Corporation have started to select irrigation schemes in Joint consultation. Power supply to these schemes are investigated by the Board and supply is arranged if technically feasible.
4. What are the rules governing the sanction of works pertaining to energisation of pump sets and electrification of villages? Is it on the basis of minimum returns? If so, what is the minimum return which entitles a work to be sanctioned? How is the minimum return estimated? The Proforma Annexure I and II attached herewith may be replied.	4. Estimates for the electrification of villages or extension of power lines for giving supply to agricultural pumpsets are sanctioned on minimum guarantee basis if the extension is found to be unremunerative. 10% revenue return on the capitalised cost of the work for a period of 3 years is the minimum now prescribed. Minimum return is estimated as follows:— A. Domestic consumer : Rs. 40 per annum. B. Agricultural " Rs. 15 per H.P. p.a. C. Industrial "Rs. 50 per H.P. p.a.

1	2
5 Please furnish the constructional details in respect of the sub-transmission and distribution lines in the proforma Annexure-III.	5. *See* Annexure III.
What are the sizes of Distribution Transformers generally used? Drawings showing standard installations of transformer centres may be furnished, showing the scheme of connections on the H. T. and L. T. sides, distribution boxes etc.	6. 50 KVA and above are normally used.
7. What is the cost of transformer centre installations for various capacities generally in use? The labour content in each may be separately shown.	7.

	Total cost	Labour provided in data
	Rs.	Rs.
50 KVA .	7,770	100
100 KVA .	9,970	100

The following may be furnished in respect of the L.T. distribution lines and the method of voltage control.	
(a) Maximum length of any branch extended from the Transformer Centre in metres.	8. (a) 2·5 to 3 K.M.
(b) Size of phase conductor	(b) A,A.C. 7/110 and 3/·144 7/·1228 7/·1093 7/·1093 7/·0975
(c) Load permitted	(c) Depends on the size of conductor.
(d) Voltage drop permitted.	(d) ± 8%
(e) Minimum no load voltage on the H.T. and L.T. sides of the transformers generally obtaining in the system.	(e) Minimum no load voltage at distribution transforme point H.T. L.T.
(f) (i) The method of tap changing of the power transformer in the substations whether off load or on load.	(f) (i) Both off load and on load are used. Mostly on load system.
(ii) Whether any booster transformers or auto transformers have been used on long sub-transmission lines if so, the range of voltage regulation of such transformers.	(ii) Booster transformers have been used.
(ii Whether any capacitors have been used for P.F. and voltage improvement and the scope of their influence.	(iii) Capacitors have not been used in our system.
9. What are the normal channels of financing? Details may be furnished showing the agencies from which finances are raised, the interest charges, important terms of advancing the funds, whether such terms are favourable or not etc.	9. At present the State Government is sponsoring the Rural Electrification Scheme by loans. Rates and conditions of interest and repayment have been furnished in reply to the first questionnaire itself. The terms of repayment and interest charged are found to be not favourable since the Rural Electrification Schemes in certain cases are not found to fetch adequate return on the capitalised cost of the work even after the prescribed period of 3 years.
10. What is average cost per H.P. for supplying Power to the Agriculturists?	10. This will vary very (widely depending on the construction cost of the distribution lines involved.
11. What is the power tariff in respect of agricultural loads?	11. 9 ps. per unit (as per the latest tariff) subject to a minimum of Rs. 7·00 per meter per month.
12. What will be the cost of energy per KWH at the agriculturist end?	12. Agricultural consumers take power at L.T. The cost per unit of energy supplied from the L.T. distribution mains is 28,156 ps. for the financial year 1968-69. This cost includes cost of generation, E.H.T. and H.T. transmission and L.T distribution.

सत्यमेव जयते

1	2
13. What are the financial involvements to the agriculturists in regard to wiring of his installation etc. before he is able to obtain power service from the Board?	13. The consumer has to meet the cost of wiring and erection of equipments and remit application fee (Rs. 2·00) Testing fee (Rs. 5·00) and security deposit depending on the probable current consumption charges for a period of 3 months before getting power supply.
14. In the event the Board is incurring a loss when viewed from Venkataraman Committee's recommendation on this account, is it being subsidised by the State Government or how is it being dealt with?	14. The Venkataraman Committe has suggested that the Electricity Boards should consider the possibility of reducing or abolishing altogether minimum guarantee levied on agricultural consumers. Please refer to recommendation (16) of the Committee. To this suggestion, the Government of India have endorsed the view of the Conference of Chairmen of State Electricity Boards that the minimum consumption guarantee on agricultural consumption should be Rs· 35·00 for connected H.P. per annum. No subsidy is received by the Board from Government at present, for supply of energy to Agricultural consumers.
15. Are there any cases of default on the part of the agriculturist in availing power supply after the same has been sanctioned?	15. Very stray cases only.
16. What are the reasons in your opinion for such defaults? Is it lack of funds with the party to carry out its portion of work or any other reason?	16. Probably lack of finance may be the reason.
17. What is the organisational set up to take care of the Rural Electrification works right from investigation and Planning stage upto the completion of the work and giving service connections?	17. There is no special organisation to formulate Rural Electrification programme and attend to such schemes. Regular distribution staff are attending to Rural Electrification work also. Some special construction section (with one Junior Engineer and overseer for each unit) have been formed to handle major Rural Electrification Schemes.

ANNEXURE I

Supplementary Questionnaire	Reply to the Questionnaire			
	Third Plan	1966-67	1967-68	1968-69
1. Number of schemes investigated	2650	350	405	462
2. Schemes for which estimates were prepared	2208	342	406	439
(a) No. of pumpsets involved				
(b) No. of villages involved				
3. Schemes actually included in the programme	1450	152	124	147
(a) Number of Schemes				
(b) No. of pumpsets covered				
(c) No. of villages covered				
4. If the number of schemes taken up is comparatively small to the number investigated, the reason for the same; whether it is due to want of funds, non-feasibility with reference ro revenue returns or any other reason.	(1) Dearth of materials. (2) Delay in execution of minimum guarantee agreements by beneficiaries.			
5. Schemes completed:—				
(a) No. of schemes	810	57	53	52
(b) No. of pumps energised	4291	1,538	3,001	4,493
(c) No. of villages electrified	211	17	22	15
6. If the number of schemes completed are comparatively small, the reasons for the shortfall; whether due to paucity of materials, inadequate organisation or any other reason.	6. Short supply of materials and delay in complying with the minimum guarantee formalities by the beneficiaries.			

ANNEXURE II

Supplementary Questionnaire	*Reply to the Questionnaire*			
	Third Plan	1966-67	1967-68	1968-69
1. Period	..	..	..	..
2. No. of pumpsets programmed to be energised	..	..	989	1,470
3. Area estimated to be irrigated in acres	..	..	..	..
4. Estimated cost (in Rs. lakhs) of energisation of the pump sets inclusive of sub-transmission lines where involved	..	..	..	..
5. Provision in the plan in Rupees lakhs	..	..	..	..
6. Pumpsets actually energised				
(a) Number	4,291	1,538	3,001	4,493
(b) Aggregate KW	17,997	16,734	4,679	12,994
7. Outlay incurred				
(a) Total in Rs. lakhs	..	..	..	..
(b) Average per HP in Rs.	..	..	..	..
8. Average length of line per HP in metres				
(a) Sub-transmission line	..	..	..	..
(b) Distribution line	..	..	..	..
9. Area brought under irrigation.				
(a) Aggregate acres	..	..	..	..
(b) Acres per HP	..	..	..	..
10. Estimated food production in tone per HP	..	..	..	..
11. Estimated revenue to the Electricity Board	..	..	..	..
12. Power tariff in paise per Kwh adopted to evaluate the revenue return	(1) 8 ps. per Kwh for unit consumed. (2) Rs. 15 per hP of connected load for estimating revenue return.			
13. Percentage return on investment	..	..	..	..

N.B.—Other details are not furnished since the No. of pumpsets shown above include pumpsets coming under major L. T. schemes and also pumpsets in already electrified localities.

ANNEXURE III

Constructional details of lines

	Tubular steel Poles		Fabricated steel Poles		R. C. C. Poles		Wooden Poles		Any other kind of Poles	
	Subtr. line	Distr. line	Subtr. line	Distr. line	Subtr. line	Distr. line	Subtr. line	Distr. line	Subtr. line	Distr. line
	11 KV	M&LV	11 KV	M&LV	11 KV	M&LV	11 KV	M&LV	11 KV	M&LV
1. Height of the line support in metres.	Not in use	..	Not in use	..	..	..	..	..	..	..
2. Span in metres	..	50	..	..	100	50	100	50	(Average)	
3. Size of conductor	..	AAC 7/.110	..	..	ACSR MINK	AAC 7/.110	ACSR mink	AAC 7/.110	..	..
4. Minimum ground clearance metres	As per Electricity Rules									
5. Frequency of grounding	At four locations per mile.									
6. Frequency of earth guards used if any	..	..	..	..	..	..	..	..	..	..
7. Depth of pole under ground	..	..	..		1.2 to 1.8 metres	..	..	..	..	..
8. Cost in Rs. of the line per KM	..	Rs. 9,550	..	..	Rs. 7,860 3 phase	8,700	7,860 3 phase	..	...	..
9. Labour content Rs. 250	..	..	..	Rs. 250	400	250	..	..	..	..

TAMIL NADU ELECTRICITY BOARD

PART I

Questionnaire regarding Rural Electrification in the State	Reply to the Questionnaire
1	2
1. Average distance to consumer's well from the low tension line in electrified village	1. 0.25 Km
2. Average distance to a village proposed to be electrified from the existing high tension lines.	2. 2.0 Km.
3. Estimated expenditure of laying high tension line per Km.	3. Rs. 5,275 (average)
4. Estimated expenditure for laying low tension line per Km.	4. Rs. 4,350
5. Approximate number of consumers to be served from the transformer in any village and transformer size (KVA)	5. 20 Nos. agricultural consumers from (50MVA) transformers.
6. What should be load factor in case of agricultural connection for preparation of estimates.	6. 0.3
7. What is the yardstick for sanctioning different categories of line staffs in Rural areas for proper maintenance	7. The following is the staff in rural areas for operation and maintenance : (i) One line Inspector Grade II. (ii) One Lineman Grade I and (iii) One Commercial Assistant. (iv) One helper for every 3 transformers. } for 30 Distribution Transformers or 2000 services. (v) One wireman for every 5 transformers.
8. What is the procedure for attending fuse calls and maintenance in Rural areas.	8. The distribution staff attending to a fuse off call, note the fuse off call hour and the name of the consumer who called in a card and after renewal of fuses complete the card and obtain the signature of the consumer. The number of fuses renewed is also noted in the card. On return to the distribution office entries are made in the fuse off coll book in duplicate and the card sent to the Central office of the system. At the end of the month one copy of entries in the fuse call book is sent to the Central office alongwith meter cards for charging the consumer. A charge of 75 paise upto 25 amps and Re. 1 upto 100 amps is charged per call irrespective of the number of fuse renewed, including unnecessary calls.
9. Whether the internal installations of agricultural connection including pumps and motors are maintained departmentally or by the consumer himself ?	9. Internal wiring and installations are maintained by the consumer.
10. What facility has been allowed to the agricultural consumers for utilising the motor of the pumping set for use other than irrigation ? Is use of the agricultural pumping connection for other purposes such as farm lighting and other appliances etc. permitted ?	10. The agricultural consumers are permitted to utilise motor for grain thrashing and sugarcane crushing in addition to the irrigation subject to the condition that they are not on industrial scale and the operation are carried out in the land or premises, of the consumer. The consumption is charged at the agricultural tariff. A testing fee of Rs. 5 is levied at the time of giving the service with change over suitability. The agricultural consumers are permitted lighting upto 50 watts per 1000 watts of motive power connected subject to a maximum of 150 watts for a farm use and the consumption is charged at agricultural tariff.

PART II

1	2
1. Electricity consumed per pumpset H.P. per year.	1. 260 units per paddy crop per acre.
2. Annual cost per acre per crop for electric pumping for different crops.	2. The cost per crop per acre is Rs. 50 (including depreciation maintenance and electricity).
3. Net return per pumpset (after taking into account transmission losses and other overheads).	3. Schemes for extension of supply to agricultural pumpsets are sanctioned as the basis of a gross return of 10% in the I year. For a scheme to prove remunerative the gross return should be about 25%. Schemes for the supply of pumpsets are executed if the gross return is 10% and above in the first year in the hope that additional load would come forth in the distribution course of time and make the scheme self supporting.
4. What is the system of meter reading, billing and collection of energy charges in the Rural areas ?	4. The meter readings are taken by authorised departmental staff on fixed dates and full particulars for billing purposes are noted. In the central office of the system the bills are prepared and checked. H. T. bills are sent direct to the consumers and L. T. bills with permanent receipts are sent to the Bill collectors who in turn serve the bills on the consumers within 3 days of the receipt of bills. Payments are then received by the bill collectors at their office and permanent receipts are issued to the consumers by the bill collectors. Each days' collection is handed over to the Junior Engineer/Supervisor by the bill Collector for Safe Custody. The Collections are remitted into the treasury weekly by the Section Officer or by the bill Collectors subject to the condition that the un-remitted amount does not exceed Rs. 5000 at any time.
5. What other types of agricultural processing machineries are permissible under the agricultural tariff and upto load.	5. Grain thrashing, Sugar cane crushing and small cottage industries are permitted to be charged under agricultural tariff as explained under item 10 of Part I.
6. At what rate electricity is supplied in villages for street lighting.	6. (a) Rs. 30 per street light per annum for 40 Watts Filament lamps. (b) Rs. 60 per street light per annum for 2 × 20 watts Flourescent lamps. The above rates are inclusive of limited renewals per annum.
7. What is the break up of financial assistance if any, received from different Financial Institutions for Rural Electrification Scheme for the year 1966-67 and onwards ?	7. There is no separate loan sanctioned for Rural Electrification. The loans got for Project works, Transmission and distribution of Rural Electrification during the past 3 years were as follows :

		Rs. in lakhs	
	1966-67	1967-68	1968-69
1. Loan from Government of Tamil Nadu	975.00	1403.00	1883.00
2. Life Insurance Corporation . . .	200.00	200.00	325.00
3. Banks	..	..	750.00
4. Open Market	330.00	302.50	440.00

8. What was their condition of repayment of loans and interest charges ?	8. 1. *Loan from Government of Tamil Nadu.* Rate of interest for the loans obtained during the year 1966-67 and 1967-68. 6.75% per annum Rate of interest for the loans obtained during the year 1968-69 7% per annum

सत्यमेव जयते

PART II—*Contd.*

1	2
	2. *Loans from Life Insurance Corporation :* The loans were secured by a first legal mortgage of fixed assets of the Board, having a depreciated book-value or Market value whichever was lower of not less than 3 times the aggregate amount of loan advanced. (This has since been reduced to 2 times the aggregate amount). The loans were repayable in 20 equal annual instalments, commencing from the end of one year from the date of drawal of loans. Rate of interest 7 3/4% per annum with a rebate of 1/2% for prompt payment of instalments of principal and interest being payable half yearly by 1st April and 1st of October. Properties mortgaged are insured with Life Insurance Corporation for fire and other risks. 3. *Loans from Banks :* The loans from Banks are guaranteed by the State Government under Section 65 of the Electricity Supply Act, 1948. The loans advanced by the Syndicate Bank (Rs. 2 crores) and by the Bank of India (Rs. 3 crores)are also secured by the hypothecation of certain stores by the Tamil Nadu Electricity Board, while that advanced by Punjab National Bank (Rs. 2 crores) is secured by mortgage of certain E.H.T. transmission Lines of the Board. The loans from Indian Overseas Bank is on Government Guarantee only. All the Bank loans carry interest at 3% per annum over Bank rate subject to a minimum of 8% per annum. Interest being payable quarterly (except for Indian Overseas Bank) where it is payable half yearly terms of repayment are as under :— *Punjab National Bank :* In 5 annual equal instalments of Rs. 40 lakhs each commencing from 1-2-1971 and on 1st February of each year upto 1-2-1975. *Indian Overseas Banks :* In 2 equal instalements at the end of the 4th and 5th year. *Syndicate Bank :* In 5 years, 3 approximate equal instalments after an initial holiday of 2 years the first instalment being due at the end of the 3rd year, the second instalment at the end of th 4th year and the final instalment at the end of the 5th year. *Bank of India :* In three equal annual instalments the first instalment on 31-3-72 and the 2nd on 31-3-73 and the 3rd on 31-3-74. 3. *Open Market Loans :* Loans taken in 1966-67 carry interest at 5¾% per annum and the loans taken in 1967-68 and 1968-69 at 6% per annum. The Loan taken in 1966-67 mature for repayment in 1979 and the loans taken in 1967-68 and 1968-69 in 1980.

सत्यमेव जयते

ASSAM STATE ELECTRICITY BOARD

PART I

Questionnaire regarding Rural Electrification in the States	Reply to the Questionnaire
1	2
1. Average distance (km) to consumer's well from the low tension line in electrified village.	1. Does not arise as no service connection is yet given for pumping from deep wells.
2. Average distance (km) to village proposed to be electrified from the existing high tension line upto 33 kV.	2. 0.5 to 1.0 Km
3. Estimated expenditure of laying high tension line per Km (11,22 and 33 kV)	3. 11 kV—Rs. 10,000.00 per km 22 kV—is not yet in vogue. 33 kV—Rs. 13,000.00 per km.
4. Estimated expenditure for laying low tension line per Km.	4. 15,000.00 per Km for 3 phase service.
5. Approximate No. of consumer to be served from the transformer in any village and transformer size (KVA)	5. 25 KVA—20 to 25 consumers : 50 KVA—40 to 50 consumers ; 100 KVA—80 to 100 consumers ;
6. What should be load factor in case of Agricultural connection for preparation of estimates ?	6. 15%
7. What is the yardstick for sanctioning different categories of line staffs in Rural Areas for proper maintenance ?	7. It is dependent on the number of distribution substations, lengths of H.T. and L.T. Lines.
8. What is the procedure for attending to fuse calls and maintenance in Rural Areas.	8. Fuse calls are attended to, from distribution centres, by linemen, on receipt of telephonic or written complaints. Linemen maintain the lines in different sections thereof by patrol on foot from their respective camps and each section is allotted separately to each lineman for the purpose.
9. Whether the internal installations of agricultural connection including pumps and motors are maintained departmentally or by the consumer himself.	9. Maintained only by the consumer.
10. What facility has been allowed to the agricultural consumers for utilising the motor of the pumping set for use other than irrigation ? Is use of the agricultural pumping connection for other purposes such as farm lighting and other appliances etc. permitted ?	10. (1) None (2) No as per tariff.

PART II

1. Electricity consumed per pump set H.P. per year.	1. 235 units (approx.)
2. Annual cost per acre per crop for Electric pumping for different crops.	2. Rs. 15.80 per acre for electric pumping per crop.
3. Net return per pumpsets (after taking into account transmission losses and other overheads)	3. Rs. 368.00 per annum for 20 H.P. pumps.
4. What is the system of meter reading, billing and collection of energy charges in the rural areas ?	4. Meter Reading is taken once a month by Meter reader Bill Assistant makes out the Bill, thereafter sending them by post & collects the energy charges on pre-notified dates and twice a month.
5. What other types of agricultural processing machineries are permissible under the agricultural tariff and upto load.	5. None as per tariff.
6. At what rate electricity is supplied in villages for street lighting ?	6. Schedule VI public lighting only. *Tariff* Gross rate — *Rebate* 3 paise/Kwh. (1) 31 paise per Kwh. (i) This rate is inclusive of all charges in regard to replacement of lamps and maintenance of street light fittings lamps etc.

PART II—*Contd.*

1		2	
		(ii) Alternate all in rate :	
For each lamp of 40 *Watts.*		*Gross rate*	*Rebate*
-do-	60	Rs. 3.70 per month	20 paise
-do-	100	Rs. 4.80 per month	30 paise
-do-	200	Rs. 6.45 per month	45 paise
-do-	500	Rs. 8.55 per month	55 paise
above	500 W & upto 1 KW.	Rs. 12.90 per month	90 paise
		Rs. 16.00 per month	Rs. 1.00
		(iii) for special fixtures like mercury vapour lamp and flourescent lamp etc.	
For each lamp upto 50 *Watts.*		*Gross rate*	*Rebate*
-do-	100	Rs. 10.85 per month	85 paise
-do-	200 Watt and above	Rs. 16.00 per month	Re. 1.00
		Rs. 21.70 per month	Rs. 1.70
7. What is the break up to financial assistance, if any received from different Financial Institutions for Rural Electrification Schemes for the year 1966-67 and onwards ?		7. Amount sanctioned by State Government	Central assistance released by Govt. of India
		*1966-67 Rs. 90 lakhs	Rs. 59.59 lakhs
		1967-68 Rs. 70 lakhs	Rs. 60.00 lakhs
		1968-69 Rs. 60 lakhs	Rs. 60.00 lakhs
		1969-70 not sanctioned.	Not yet released.
8. What was their condition of repayment of loans and interest charges?		8. Conditions for repayment of loan and interest charges yearwise.	

---

*1966-67 : Loan was deemed to have been granted on 1-10-66 *vide* Govt. of India's letter No. EL. II26(2)/67, dated the 15th March, 1967. The loan bearing interest of 8¼% per annum is repayable in 20 equal annual instalments of principal with interest due on the outstanding capital from time to time commencing from 6th anniversary of the drawal of the loan. During the first five years, *i.e.*, from 1967-68 to 1971-72 only the interest charges will be payable annually. In the event of punctual payment of instalments of the principal and/or interest by the due dates, interest will be charged at the rate of 5¾% per annum only.

1967-68 : Loan was deemed to have been granted on 1-10-67 *vide* letter No. EL-II-26(2)/68, dated 22-3-68. As regards repayment of loan and interest charges same conditions as for 1966-67 apply.

1968-69 : Loan was deemed to have been made on 1-10-68 bearing interest charge @5¾% per annum, and is repayable in 20 equal instalments of the Principal with interest due on the outstanding capital from time to time commencing from the 6th anniversary of the drawal of the loan. During the first five years, *i.e.*, from 1969-70 to 1973-74 only the interest charges will be payable annually. A rebate of ¼% will be admissible for timely repayment of Principal and/or interest thereon, interest at the penal rate of 8¼% would be chargeable on all over due instalments (Letter No. EL-II-26(2)/69, dated 19-3-69.

MAHARASHTRA STATE ELECTRICITY BOARD

PART I

Questionnaire Regarding Rural Electrification in the States	Reply to the Questionnaire
1	2
1. Average distance to consumer's well from the L.T. Line in electrified village.	1. The L.T. Lines are extended upto the consumer's well and the end pole is installed within the distance of about 33 Meters.
2. Average distance to a village proposed to be electrified from the Existing H.T. Lines upto 33 Kv.	2. The proposals for R.E. are framed for the groups of the villages. The average distance of the proposed village from the existing H.T. Line—upto 33 kV is about 3 Kms.
3. Estimated expenditure of laying H.T. Line per K.M.	3. The estimated expenditure of laying H.T. Line per Km is taken as under : (a) 11 kV—Rs. 7,670 (b) 22 KV—Rs. 9,600 (c) 33 KV—Rs. 12,500
4. Estimated expenditure for laying H.T. Line per K.M.	4. The estimated expenditure for laying L.T. Line per K.M. is Rs. 5,594.
5. Approximate number of consumers to be served from the Transformer in any village and transformer size.	5. The estimate of a village is prepared on the following basis : (a) H.T. Line—3 Kms. (b) L.T. Line—4 Kms. (c) Transformer centre—100 KVA. (d) Ag. pumps—10 nos. *Note* : The priority is given for connections of agricultural pumps. Other types of consumers are given connections as and when possible.
6. What should be load factor in case of agricultural connection for preparation of estimates ?	6. The load factor of 75% is assumed for Ag. pumps for preparation of estimates.
7. What is the yard-stick for sanctioning different categories of line staff in Rural Areas for proper maintenance?	7. The Operation & Maintenance staff sanctioned in Rural area is as under : The base is taken as group of five villages with at least 300 Nos. of consumers : (a) Sub-Engineer 1 No. (b) Lineman 1 No. (c) Asstt. Lineman 2 Nos. (d) Line-helpers 3 Nos. TOTAL . 7 Nos.
8. What is procedure for attending fuse calls and maintenance in Rural Areas?	8. A fuse-cell-register is kept in the office of the Sub-Engineer and all the fuse call complaints are recorded in the register and they are attended as early as possible, alloting the work to the staff as per nature of the complaint. The routine maintenance programme is given by the sub-divisional Officer and the same is being attended to by each unit.
9. Whether the internal installations of agricultural connection including pumps and motors are maintained departmentally or by the consumer himself?	9. The Board is responsible to maintain the power supply upto Meter position which is the point of supply on the premises of the consumer. The internal installation is to be looked after by the consumer himself

PART I—*Contd.*

1	2
10. What facility has been allowed to the agricultural consumers for utilising the motor of the pumping set for use other than irrigation ? Is use of the agricultural pumping connection for other purposes such as farm lighting and other appliances etc. permitted ?	10. For an agricultural consumer a special L.T. tariff rate is provided. The minimum bill charges at concession of special seasonal minimum bill facility is given. The energy bills are prepared on six monthly period so that they reap-harvest. An use of one Pilot lamp of 40 watts in the power circuit is permitted to check up the continuous supply. The motor of the pumping set is allowed to be used for cane crusher, fodder cutter and other agricultural purpose.

PART II

1	2
1. Electricity consumed per pump set H. P. per year.	1. Electricity consumption 1884.4 units/H.P. per year. Electricity consumption 443.7 units/pump set per year.
2. Annual cost per acre per crop for electric pumping for different crops.	2. This information is not available with the Board.
3. Net return per pump-set (after taking into account transmission losses and other overheads).	3. As per administrative report for the year 1968-69, the net average return per ag. pump consumer, is Rs. 273 per year.
4. What is the system of meter reading, billing and collection of energy charges in the rural areas ?	4. For domestic lights and fans—quarterly where the population is less than 10,000. For agricultural supply—six monthly. For General Motive power and H.T. consumers—monthly and street lights. The bills are collected at the Branches of District Co-operative Bank.
5. What other types of agricultural processing machineries are permissible under the agricultural tariff and upto what load ?	5. The Agricutural tariff is available for the purpose of operating a cane crusher and fodder cutter etc.
6. At what rate electricity is supplied in villages for street lights ?	6. *Energy Charges :* 20 p/unit for the first 200 units consumed per month per KW. 6 p/unit for all additional energy consumed during the month, *plus* Fixed charges. (i) For st. lights provided on the distribution lines of the Board already laid for supply to the general public Rc. 1 per lamp per month. (ii) For st. lights required in areas where the Board's distribution lines are not laid : (a) per pole with lamp Rs. 2.50 per month. (b) Per pole with out lamp Rs. 2.25 per month.
7. What is the break up of financial assistance, if any, received from different Financial Institutions for Rural Electrification Scheme for the year 1966-67 and onwards ?	7. For Rural Electrification Scheme, no financial assistance is received from any Financial Institutions for the year 1966-67 and onwards. The loan is sanctioned by the State Government on 1st October of each year being in perpetuity and bears the interest at 6%. In the year 1969-70 the loan is obtained from the Agricultural Finance Corporation for connecting Agricultural pump in the already electrified village. The rate of interest is 8½% with concession of ½% for prompt payment. The loan is to be refunded in 10 years; first installation commencing after 2nd year.
8. What was their conditions of repayment of loans and interest charges ?	8. Information is given in above para.

GUJARAT ELECTRICITY BOARD

PART I

Questionnaire Regarding Rural Electrification in the States	Reply to the Questionnaire
1	2
1. Average distance to consumer's well from the L. T. Line in electrified villages.	1. The average distance to the consumer's well from the transformer sub-station or existing L.T. Line in electrified areas come to about 0.231 K.M.
2. Average distance to a village proposed to be electrified from the existing H.T. Lines upto 33 kV.	2. The average distance to be proposed to be electrified from the existing H.T. Lines *i.e.* 11 or 22 KV is about 3.5 K.M.
3. Estimated expenditure of laying H.T. Line per K.M.	3. Detailed estimates of expenditure for laying HT. Line for 11-KV/22-KV are enclosed herewith. The estimated cost for 11-KV line per km. is Rs. 7,550 and for 22-KV is Rs. 8,100.
4. Estimated expenditure for laying L. T. Line per K.M.	4. The detailed estimate of expenditure for laying L.T. Lines per KM is attached herewith. The estimated expenditure is Rs. 8,150 per K.M.
5. Approximate number of consumers to be served from the Transformer in any village and transformer size.	5. The approximate number of the consumers to be served from the transformer centre according to the capacity of the transformer centre is given below :

	Number of consumer	
	Minimum	Maximum
100 KVA transformer centre	7	23
50 KVA transformer centre	5	15
25 KVA transformer centre	1	8

6. What should be load factor in case of agricultural connection for preparation of estimates ?	6. For preparing the estimates the load factor of agricultural consumers is taken as about 18% average.
7. What is the yard-stick for sanctioning different categories of line staff in Rural Areas for proper maintenance ?	7. As per the statement I attached.
8. What is procedure for attending fuse calls and maintenance in Rural Areas ?	8. Helpers and/or Assistant Lineman who are posted in the villages attend to the fuse calls from the consumers. For maintenance work on H.T. Line work is being arranged under the supervision of the technical assistant or line inspector by the special maintenance gang and the Helpers posted in the villages are also called upon to assist this gang in case of major work.
9. Whether the internal installations of agricultural connection including pumps and motors are maintained departmentally or by the consumer himself.	9. The Board is supplying power to the agricultural consumers upto the metering point. The Board is responsible for the maintenance of the service line upto the meter. The installation of the consumer after the meter including motor is to be maintained by the consumer himself.
10. What facility has been allowed to the agricultural consumers for utilising the motor of the pumping set for use other than irrigation ? Is use of the agricultural pumping connection for other purposes such as farm lighting and other appliances etc. permitted ?	10. The agricultural consumers are allowed to use their motors (installed for pumping purpose) for industrial purposes after six months from the date of release of power supply subject to the condition that the installation shall be outside the limits of Municipality or Municipal Corpn. as the case may be. The power taken for agricultural purpose is not permitted to be used for lighting connection and for other domestic appliances for which consumer must necessarily take separate connections. The consumer has, however, got facility of paying lesser service connection charges if he takes the lighting connection in addition to agricultural connection viz., for such a tapping, he is required to pay service connection charges of Rs. 35 only (for single phase) instead of normal charges of Rs. 60 per service.

Estimate for 11 KV Line/Km

Sl. No.	Particulars	Quantity	Rate Rs.	Amount Rs.
1	Survey and Tree cutting	L.S.	..	50.00
2	P. S. C. Poles 30' long.	11	145	1,595.00
3	Steel pole 116 × 100 mm	1	200	200.00
4	V. Cross-arms	11	15	165.00
5,	Double V. Cross arms	1	30	30.00
6	Top insulator fitting	12	5.75	69.00
7	Two way strain clamp	1	6.30	6.30
8	Guy Sets complete	6	40	240.00
9	Earthing sets	4	21	84.00
10	Anti-climbing device	3	8	24.00
11	Caution and Danger Board	3	1	3.00
12	Concreting of guys	L.S.	..	125.00
13	Pin insulators 11 kV	36	10	360.00
14	Strain insulator	6	20	120.00
15	Power conductor, accessories and G. I. Wire as continuous earth wire	3.06 KM	..	4,470.00
			TOTAL .	7,541.30
		Say Rs. 7,550		

सत्यमेव जयते

Estimate for 22 KV Line/Km

Sl. No.	Particulars	Quantity	Rate Rs.	Amount Rs.
1	Survey and tree cutting	L.S.	..	50.00
2	P. S. C. Poles 30' long	11 Nos.	145	1,595.00
3	Steel Poles 116 × 100 mm	1 No.	200	200.00
4	V. Cross arms	11 Nos.	20	220.00
5	Double V. cross-arms	1 No.	40	40.00
6	Top insulator fitting	12 Nos.	5.75	69.00
7	Two way strain clamp	1 No.	6.30	6.30
8	Guy sets complete	6 Nos.	40	240.00
9	Earthing sets	4 Nos.	21	84.00
10	Anti-climbing device	3 Nos.	8	24.00
11	Caution and danger Boards	3 Nos.	1	3.00
12	Concreting of guys	L.S.	..	125.00
13	Pin insulators	36 Nos.	20	720.00
14	Strain insulators	6 Nos.	40	240.00
15	Power conductors, accessories & G. I. Wire as continuous earth wire	3.06 KM	..	4,470.00
			TOTAL .	8,086.30
		Say Rs.8,100		

Estimate for L.T. Line per Km.

Sl. No.	Particulars	Quantity	Rate Rs.	Amount Rs.
1	Survey and tree cutting	L.S.	..	50.00
2	P. S. C. Poles 28' long	14	145	2,030.00
3	4' pin cross-arms	14	14	196.00
4	Top insulator fitting	14	5.75	80.50
5	Earthing sets	6	21	126.00
6	Guy sets	6	40	240.00
7	Concreting of guys	L.S.	..	125.00
8	L. T. Pin insulator	40	1.50	60.00
9	L.T. Shackle insulator	24	1.75	42.00
10	All aluminium conductiots and G. I. Wire as earth wire	4.08	..	5,223,00
			TOTAL .	8,172.50
		Say Rs. 8,150		

REPLY TO PARA 7, PART I, OF QUESTIONNAIRE

Yardstick for sanction of different categories of line staff in Rural Area

Item 7. Yardstick for sanction of different categories of line staff in rural areas was devised on the following basis at a time when the villages were being electrified for all purposes:—

Sl. No.	Number of consumers	Helpers	Asstt. Wireman	Wireman	Line Inspector	Total
1	Upto 300	1	..	..	..	1
2	300/500	1	1	..	..	2
3	500/1000	1	1	1	..	3
4	1000/2000	2	1	1	..	4
5	2000/3000 and so on	3	1	2	1	7

सत्यमेव जयते

In addition to the above staff for the purpose of maintenance of transformer centres and H.T. lines, the following staff is sanctioned:—

Sl. No.	Type	Line Inspector	Lineman/ Wireman	Asstt. Lineman	Helper	Technical Asstt.	Total
1	Group of Transformer Centres						
	(a) Upto 7 villages and/or 15 transformer centres	..	1	...	1	..	2
	(b) 8 to 15 villages and/or 30 transformer centres	1	1	1	2	..	5
	(c) Above 15 villages and/or more than 30 transformer centres	1	2	1	3	1	8

At present villages are being electrified mainly for agricultural purposes intitially, as such one helper is being provided for 2 or 3 villages separated by not more than 5 Km, if these villages are electrified only for agricultural purposes.

PART II

1	2
1. Electricity consumed per pump set H.P. per year.	1. The Electricity consumed per pump per H.P. is 1105 KWH.
2. Annual cost per acre per crop for electric pumping for different crops.	2. Not available with the Board.
3. Net return per pump-set (after taking into account transmission losses and other over-heads).	3. The Board is losing Rs. 150 to Rs. 200 per pump set.
4. What is the system of meter reading, billing and collection of energy charges in the rural area ?	4. The Board has combined the functions of meter reading and billing. Under this system the clerk readers the consumption from the meter installed at consumer's premises and prepares the bill thereafter immediately on the spot (at the consumer's premises only) and delivers it to the consumer. Thus time lag between date of meter reading and date of preparing the bill is eliminated. This has helped the Board in expediting realisation of dues from the consumers. For collection of the dues, Board has got three differen system *viz :* 1. Through the Banks. 2. At the counter in the Sub-Divisional Offices of the Board. 3. Board's bill collector visits each village where Boar has got neither collection office of its own nor arranged ment with the Bank for collection, on certain selected days every month Number in each month vary from village to village depending upon the quantum of work involved for collection of the bill amount. The local consumers can pay the bill to this bill collector.
5. What other tyypes of Agricultural processing machineries are permissible under the agricultural tariff and upto what load ?	5. The agricultural consumers are allowed to use their motors (installed for pumping purpose) for industrial purposes after six months from the date of release of power supply subject to the condition that the installations shall be outside the limits of Municipality or Municipal Corporation, as the case may be. The power taken for agricultural purpose is not permitted to be used for lighting connection and for other domestic appliances for which consumer must necessarily take separate connections. The consumer has however got facility of paying lesser service connection charges if he takes lighting connection in addition to agricultural connection *viz.* for such a tapping, he is required to pay service connection charges of Rs. 35 only (for single phase) instead of normal charges of Rs. 60 per service. Further, there is no limit to the load but the condition is that the same motor which is used for agricultural purposes should be used for industrial purpose by providing countershaft *i.e.*, there should not be any additional load on account of the use of power for industrial purpose. There is no limit to the agricultural load being utilised for industrial purpose if the conditions stipulated are complied with.
6. At what rate electricity as supplied in villages for street lights?	6. The power for street lighting service is supplied under two part tariff *viz.* fixed charges and running charges. The detailed schedule of current rates for street lighting service is attached herewith.
7. What is the break-up of financial assistance, if any, received from different Financial Institutions for Rural Electrification Scheme for the year 1966-67 and onwards ?	7. The Gujarat Electricity Board has received loan as indicated below from the L.I.C. and Scheduled Bank for financing its Rural Electrification programme.

Year	From L.I.C.	From Scheduled Banks
1966-67	. .	. .
1967-68	240 lacs	. .
1968-69	125 lacs	108 lacs

सत्यमेव जयते

PART-II—*Contd.*

8. What was their conditions of repayment of loans and interest charges ?	8. The loans from L.I.C. carries interest @7¾ per cent per annum (with ½ per cent rebate for payment of interest and repayment of loan instalment on due dates) and is repayable in 20 yearly equal instalments The loan from the Banks carries 8% interest and is repayable in 5 yearly equal instalments. Repayment commences from end of the 6th year from the date of drawal of the loan.

PUNJAB STATE ELECTRICITY BOARD

PART-I

<table>
<tr><th>Questionnaire Regarding Rural Electrification in the States</th><th>Reply to the Questionnaire</th></tr>
<tr><th>1</th><th>2</th></tr>
<tr><td>1. Average distance (KM) to consumer's well from the low tension line in electrified village.</td><td>1. The average distance to a consumer's well from the low tension line may be taken as 4 to 6 spans of 250 each approximately 1250 feet.</td></tr>
<tr><td>2. Average distance (KM) to a village proposed to be electrified from the existing high tension lines—upto 33 KV.</td><td>2. The Rural Electrification programme in the Punjab State has since been oriented to give tubewell connections instead of laying L.D. system in the village and stress is, therefore, being laid on the energisation of tubwells rather than the electrification of villages (due to paucity of funds). Therefore, no scheme reports are being prepared exclusively for the electrification of villages and the information with regard to the average distance of a village from the existing high tension line cannot be given.</td></tr>
<tr><td>3. Estimated expenditure of laying high tension line per KM (11,22 & 33 KV)</td><td>3. Cost of 1 Km line with ACSR conductor of size (4 SWG, copper equivalent). Rs. 9,100.00
(ii) Cost of 1 KM of 33 KV line with ACSR conductor of size (0.1 Sq. inch copper equivalent) Rs. 22,000.00
NOTE.—The 22 KV system not operative in the Punjab State Beletricity Board.</td></tr>
<tr><td>4. Estimated expenditure of laying low tension line per K.M.</td><td>4. (i) Cost of L. T. line per KM with 8 SWG copper equivalent ACSR conductor. Rs. 6,000.00</td></tr>
<tr><td>5. Approximate no. of consumers to be served from the transformer in any village and transformer size (KM).</td><td>5. The estimates for giving tubewell connections in the Punjab State Electricity Board are now prepared in groups, which fall under the same local distribution system and the financial justification is worked out on the joint basis.
Accordingly an approximate figure of no. of consumers feed from a transformer is given below :—
<table>
<tr><th colspan="2"><i>Ist Case</i></th><th colspan="2"><i>IInd Case</i></th></tr>
<tr><td>(i) No. of transformer</td><td>2</td><td>(i) No. of transformers</td><td>II</td></tr>
<tr><td>(ii) Capacity of each transformer</td><td>100</td><td>(ii) capacity of each transformer</td><td>50KVA-4 Nos.</td></tr>
<tr><td>(iii) Total no. of tubewell</td><td></td><td>(iii) Total no. of tubewell</td><td>25 KVA-7 Nos.</td></tr>
<tr><td>(iv) Consumers fed</td><td>26</td><td>(iv) Consumers fed</td><td>44</td></tr>
<tr><td>(v) Total load fed</td><td>175 BHP</td><td>(v) Total load fed</td><td>296 B.H.P.</td></tr>
</table></td></tr>
<tr><td>6. What should be the load factor in case of agricultural connection for preparation of estimates ?</td><td>6. As per norms fixed by the Board on estimate for agricultural connections for irrigation purpose is considered to have been justified when the cost involved in giving the tubewell connection does not exceed Rs. 846 per B.H.P. Load factor in such cases is taken as 16%.</td></tr>
</table>

PART-I—*Contd.*

1	2
7. What is the yard-stick for sanctioning different categories of line Staffs in Rural Areas for proper maintenance ?	7. The maintenance work of the electrical equipment is being carried out by the operation and maintenance staff sanctioned for the sub-division/sub-office. The following is the yardstick for sanctioning establishment for operation and maintenance works line Hydro-Electric Power House. sub-station and Transmission line

(a) *Operation staff*

No. of consumers	Staff allowed for hilly or scattered areas L.S.	L.M.	A.L.M.	Staff allowed for plain area L.S.	L.M.	A.L.M.
(i) Upto 7000	1	3	6	1	3	4
(ii) 701 to 1400	2	6	10	2	6	8
(iii) 1401 to 2200	3	9	14	3	9	12
(iv) 2201 to 3200	4	12	18	4	12	16
(v) Above 3200	4	For every additional 1000 consumers on L/S, three L.M.S. and four A.L.Ms.				

(b) *Maintenance of* 11 *KV Lines*

Length of 11 KV	Line staff allowed for hilly stations or scattered area L.M.	A.L.M.	Line staff allowed for plain area L.M.	A.L.M.
(i) Upto 15 miles	1	3	1	2
(ii) above 15 miles				
(a) for every *additional* 10 miles	..	2	..	2
(b) For every *additional* 30 miles	2	..	1	..

(c) Posts for maintenance of 33 KV lines upto a distance of 40 miles but not less than 25 miles.

(i) Line Supdt.	One
(ii) Line Man	Four
(iii) A.L.M.	Four
(iv) Lorry Driver	One

NOTE.—The posts for a length of less than 25 miles of 33 KV line may be allowed at the scale indicated at (b) above *viz.* posts admissible for maintenance of 11 KV lines.

(d) *Staff for sub-stations*

	132 KV S/S.	66 KV S/S.	33 KV S/S.	11 KV in-door S/S.
1. S/S Operator	Four	One	..	..
2. S/S attendant	..	Three	One	Four
3. Assistant S/S attendant	..	..	Three	..
4. Oiler & cleaner	One	One	One	..
5. Chowkidar (Where necessary)	One	One	One	..
6. Foreman	One	..	..	..
7. Electrical Maistry	One	..	..	..

PART-I—*Contd.*

1	2
8. What is the procedure for attending fuse calls and maintenance in Rural area.	8. Various complaint centres have been set up in sub-divisions/Sub-offices at places conveniently approachable to the consumers. All sorts of complaints regarding the continuity of supply are lodged by the complainants at these centres where these are got registered by the line staff. The complaints are then attended by the line staff in turn. Regarding the maintenance in the Rural Areas, the same is being carried out by the operation and maintenance staff of the sub-division/sub-offices. Maintenance of various electrical equipments is a regular feature and is being done on a fixed schedule.
9. Whether the internal installations of Agricultural connections including pumps and motors are maintained departmentally or by the consumer himself ?	9. By the consumer himself.
10. What facility has been allowed to the Agricultural consumers for utilising the motor of the pumping set for use of other than irrigation. Is use of the Agricultural pumping connection for other purposes such as farm lighting and other appliances etc. permitted ?	10. Only cane crushers and Thrashers are permitted to be used by the Agricultural consumers. Lighting load of 80 watts comprising of two lamps (one inside and one outside the tubewell chamber) are also permitted to be used by the agricultural consumer.

PART-II

1	2
1. Electricity consumed per pumpset H.P. per year.	1. Due to the introduction of flat rate system on the tubewells this information is not maintained by this Board. However, as per statistics maintained during the year 1967-68 average electricity consumed per pumpset (consumer) per year works out to 3015 units or 670 units per pumpsets H.P. per year.
2. Annual cost per acre per crop for electric pumping for different crops.	2. The information may please be had from the agricultural department to whom this question relates, as it is not available in this office.
3. Net return per pumpset (after taking into account transmission losses and other over-heads.)	3. Under the flat rate system the following rate is being charged from the tubewell consumers and can be taken as net return.

(i) Load upto and including 5 B.H.P.	@Rs. 7 per B.H.P. per month *plus* Rs. 1 per B.H.P. as demand charges in lieu of service rent etc., per month.
(ii) Load above 5 B.H.P. upto and including 7½ B.H.P.	@7.50 per B.H.P. per month *plus* demand charges @Re. 1 per B.H.P. per month in lieu of service rentals.
(iii) Load above 7½ B.H.P. upto and including 10 B.H.P.	@Rs. 8 per B.H.P. per month *plus* demand charges@ Re. 1 per month per B.H.P. in lieu of service rentals.
(iv) Load above 10 B.H.P.	@Rs. 8.50 per B.H.P. per month *plus* demand charges @Rs. 1 per B.H.P. per month in lieu of service rentals.
(v) Load above 12½ B.H.P.	@Rs. 9 per B.H.P. per month *plus* demand charges @Re. 1 per B.H.P. per month in lieu of service rentals.

During the year 1967-68 average revenue per consumer per annum was Rs. 198.76.

PART-II—*Contd.*

1	2
4. What is the system of meter-reading billing and collection of energy charges in the rural areas ?	4. Since the flat rate is being charged from tubewell consumers no reading etc. are taken and bills on the rates indicated against Q. No.3 above prepared every month and sent to the consumers giving them 15 clear days for making their payments. Collection of these bills are made in the sub-offices/ sub-divisions located in the areas concerned. In other cases, monthly readings are recorded and bills sent in the manner prescribed for tubewells and collection made in sub-offices/sub-division.
5. What other types of Agricultural processing machineries are permissible under the Agricultural tariff and upto what load.	5. Upto load of 20 KW cane crushers and thrashers are permitted under the flat rate tariff of this Board.
6. At what rate electricity is supplied in villages for street lighting.	6. Street lighting supply tariff is as under :—*Schedule street lighting supply* 1. Availability : Available for street lighting systems including signal system and load and park lighting in Municipalities, Panchayats institutions (at the discretion of the supplier) etc. etc. 2. Character of service : A.C. 50, cycles, three or single phase, 400/200 volts. 3. Tariff Energy charges 15 paise per Kwh. *plus* line maintenance and lamp renewal charges. (a) *Ordinary Lamps :* (i) Lamps upto 40 watts Rs. 1.50 per lamp per month. (ii) Lamps of 60 & 75 watts Rs. 1.75 per lamp per month. (iii) Lamps of 100 watts Rs. 2 per lamp per month. (iv) Lamps of 150 watts Rs. 2.25 per lamp per month. (v) Lamps above 150 watts special quotations and special lamps (b) *Mercury Vapour Lamps :* (i) Lamps of 80 watts Rs. 8.00 per lamp per month. (ii) Lamps of 125 watts Rs. 8.50 per lamp per month. (iii) Lamps of 250 watts Rs. 14.50 per lamp per month. (iv) Lamp of 400 watts Rs. 17.00 per lamp per month. (c) *Fluorescent tube :* (i) Double 2 ft. 20 watts Rs. 7.00 per point per month. (ii) Double 4 ft. 40 watts Rs. 10.50 per point per month. (iii) Single 2 ft. 20 watts Rs. 2.75 per point per month. NOTE—In the case of street lighting supply to village Panchayat rebate of twenty five percent over the standard tariff (*i.e.* energy charges and line maintanance and lamp renewal charges all catagories) is allowed *w.e.f.* 1-4-64. 4. *Payment :*— The above rates are net. In the event of the monthly bill not being paid in full, within the time specified in the bill, a surcharge of 1 percent shall be levied on the unpaid amout of the bill for each 30 days successive period of part thereof until the amount is paid in full.

PART-II—*Contd.*

1	2
7 & 8. What is the break-up of financial assistance, if any, received from different Financial Institutions for Rural Electrification schemes for the 1966-67 and onwards ?	7 & 8 The break up of the assistance received from different Financial Institutions for Rural Electrification schemes for the year 1966-67 and onwards is as under :—
What was their conditions of repayment of loans and interest charges ?	

	1966-67	1967-68	1968-69	1969-70
1. L.I.C. of India .	..	..	Rs. 200 lacs	Rs. 150 lacs
2. Land mortage Bank under ARC Scheme for grant of T/W connections.	..	..	Rs. 23 lacs	Rs. 150 lacs
3. Commercial Bank for grant of tubewell connections.	..	..	Rs. 3.50 Lacs (Rs. 2.45 lacs refundable and Rs. 1.05 lacs non-refundable)	Rs. 43.65 Lacs (Rs. 30.55) lacs refundable and Rs. 13.10 lacs non-refundable).

L.I.C. of India

The repayment of the loans is to be made in a period of 20 years from the date of drawal of the loan in 20 equal annual instalments, the 1st of such instalment of repayment falling due at the end of one year from the date of drawal and subsequent such instalments being payable on the same date in each of the succeeding years thereafter. The loan will carry an interest of 7¾% P.A. (with a rebate of ½% for prompt payment of instalments of principal and interest) on the amount outstanding from time to time.

Interest will be payable half yearly and in default of regular payment of interest, compound interest will become payable on the money due.

The loan of Rs. 150 lacs shown under 1969-70 from L.I.C. is expected to be drawn by 15-2-1970.

सत्यमेव जयते

Land Mortgage Banks under A. R. C. Scheme

As per intimation received in this office a sum of Rs. 60 lacs has so far been received under A. R. C. Scheme, Rs. 90 lacs more are likely to be received during the remaining part of the current year @Rs. 3,000 per tubewell connection. The repayment of the deposits received under this scheme is to be made in 7 years by monthly adjustment through energy bills. The interest 6% P. A. is payable on such deposits.

Commercial Banks

A sum of Rs. 20 lacs has been received so far under the Commercial Banks Scheme and Rs. 23.65 lacs more are likely to be received during the remaining part of the current year @Rs. 5,000 per tubewell connection. Out of Rs. 5,000 per connection Rs. 3,500 are refundable and Rs. 1,500 non refundable which is treated as high priority connection fee. There are at present two different methods of repayment of the refundable amount. In case of State Bank of Patiala the repayment of the refundable amount has to be made in 5 equal instalments of the Rs. 700 each after the expiry of 5 years from the date of deposits. In case of other Commercial Bank, the repayment of the refundable amount is to be made to the farmer by monthly adjustment through energy bills after the expiry of 5 years from the date of deposit.

The interest in both the cases is 5% P. A. only on the refundable amount.

STUDY GROUP ON RURAL ELECTRIFICATION POWER ECONOMY COMMITTEE

MYSORE STATE ELECTRICITY BOARD

<table>
<tr><th>Supplementary Questionnaire</th><th>Reply to the Questionnaire</th></tr>
<tr><td>1</td><td>2</td></tr>
<tr><td>1. What are the criteria used in the planning of energisation of IP Sets and village electrification in the Plan period and the annual Plans ? Is it on the basis of existing wells in the State or on a pre-determined number comprising the existing wells and those that may come up during the course of the Plan periods ?</td><td>1. The Planning is done on the basis of finances available to the Boards from various lending institutions for these works. For, energisation of IP sets, the available amount is divided among all the talukas, taking into consideration, the number of existing wells, the number of applications pending, the under developed nature of the taluk etc.
The village electrification programme is also finalised depending upon the budgetary resources available for this work, which is determined at the time of formulation of the annual budget. The available funds are earmarked talukwise depending upon the total number of villages, the number of villages already electrified in the taluk and other relevant factors. 75% of the budget grants are reserved for electrification of villages which are within 1-1/2 KM of the existing sub-transmission lines and the balance 25% of the grants earmarked for electrification of distant populour villages in the taluk.</td></tr>
<tr><td>2. Whether the vicinity of the wells to the existing distribution lines would form an important basis of irrespective of existence of the lines wells are chosen on the demand of the agriculturists ?</td><td>2. Yes, it is an important consideration, as the present norms of the Board allow a maximum expenditure of Rs. 1,250 per HP of the prospective IP load, 50% of the Talukwise budget grant are utilised for energisation of pump sets in close proximity with the existing distribution line and where the cost of energisation falls within Rs. 1,000 per pump set, 30% of the grant are utilised energising pump sets costing between Rs. 1,000 and Rs. 2,500 per pump set and the balance 20% of the grants utilised for energising pump sets where the cost exceeds Rs. 2,500 per pump set however the limitation being Rs. 1,250 per HP.</td></tr>
<tr><td>3. Is the selection of wells made in consultation with other departments such as the Revenue Department, Agricultural Department, etc.? If so, the procedure adopted may be briefly indicated.</td><td>3. The prospective IP set consumer has to submit this power supply application in a prescribed-application, along with the water frieght certificate from the Revenue Authorities stating that the applicant has a right to use water of the wells.</td></tr>
<tr><td>4. What are the rules governing the sanction of works pertaining to energisation of pumps sets and electrification of villages? Is it on the basis of minimum returns ? If so, what is the minimum return which entitles a work to be sanctioned ? How is the minimum return estimated ?
The Proforma Annexure I & II attached herewith may be replied.</td><td>4. Estimates for power supply to IP sets, are feasible only if the cost per HP of the IP load works out to Rs. 1,250 or less. The sanction of village electrification estimate depends upon the minimum return, which is 7.5% for villages in Maidan area and 5% in Malnad area.
The minimum returns are estimated on the following basis :
1. Rs. 35 per annum for lighting installations.
2. Rs. 75 per HP per annum for motive power installations.
3. Rs. 25 per KW per month for street lights.</td></tr>
<tr><td>5. Please furnish the constructional details in respect of the sub-transmission and distribution lines in the proforma Annexure III.</td><td>5. Annexure III duly filled in is enclosed.</td></tr>
<tr><td>6. What are the sizes of Distribution Transformers Generally used ? Drawings showing standard installations of transformer centres may be furnished, showing the scheme of connections on the HT and LT sides, distribution boxes etc.</td><td>6. 25 KVA, 50 KVA and 100 KVA transformer generally used.</td></tr>
<tr><td>7. What is the cost of transformer centre installations for various capacities generally in use. The labour content in each may be separately shown.</td><td>7.<table><tr><th>Size of transformer</th><th>Total Cost of erection</th><th>Labour charges</th></tr><tr><td>25 KVA</td><td>Rs. 6,850</td><td>Rs. 263</td></tr><tr><td>50 KVA</td><td>Rs. 9,041</td><td>Rs. 281</td></tr><tr><td>100 KVA</td><td>Rs. 11,910</td><td>Rs. 330</td></tr></table></td></tr>
</table>

MYSORE STATE ELECTRICITY BOARD— *Contd.*

1	2
8. The following may be furnished in respect of the LT distribution lines and the method of voltage control :—	
(a) Maximum length of any branch extended from the transformer Centre in metres.	(a) the maximum length of branch line extended depends upon the voltage regulations as prescribed in the I.E. rules 1956, which is 5% in case of L.T. lines and 12.5% in case of H.T. lines at the tail ends.
(b) Size of phase conductor	(b) No. 2 ACSR & No. 4 ACSR depending upon the load and "ROSE" conductor for short spans upto 150 feet or 45 metres.
(c) Load permitted	(c) Load is restricted to 75% of the capacity of the distribution transformer and subject to satisfactory voltage conditions at the tail ends.
(d) Voltage drop permitted	(d) 5 per cent.
(e) Minimum no load voltage on the HT and LT sets of the transformer generally obtaining in the system.	(e) (i) 11,200/440 volts on 11 KV class transformer. (ii) 4,500/410 volts on 4.5 KV class transformer.
(f)(i) The method of tap changing of the power transformers in the substations, whether off load or no load.	(f) (i) Off load.
(ii) Whether any booster transformers or auto transformers have been used on long sub-transmission lines if so the range of voltage regulation of such transformers.	(ii) 1000 KVA voltage regulator have been used on long sub-transmission lines to improve the voltage conditions within the prescribed permissible limits.
(iii) Whether any capacitors have been used for P. F. and voltage improvement and the scope of their influence.	(iii) Static capacitors have also been used to improve voltage conditions in areas having intensive small motives power installations. Low voltages complaints have minimised in thosed areas.
9. What are the normal channels of financing? Details may be furnished showing the agencies from which finances are raised, the interest charges, important terms of advancing the funds, whether such terms are favourable or not etc.	9. Please refer Annexure IV enclosed.
10. What is average cost per H.P. for supplying power to the Agriculturists ?	10. The average cost is Rs. 3,000 per pump set and the average HP works out to 4.
11. What is the power tariff in respect of agricultural loads ?	11. 10 paise per KWH.
12. What will be the cost of energy per KWH at the agriculturist end ?	12. Energy charges are assumed at 4½% of the capital cost.
13. What are the financial involvements to the agriculturists in regard to wiring of his installation etc. before he is able to obtain power service from the Board.	13. The cost of wiring has to be borne by the farmer, which varies between Rs. 70 and Rs. 125 depending upon the position of the departments terminal pole near the farmer's well.
14. In the event the Board is incurring a loss when viewed from Venkata Raman Committee's recommendation on this account, is it being subsidised by the State Government or how is it being dealt with ?	14. This is under correspondence between the Board and the Government.
15. Are there any cases of default on the part of the agriculturist in availing power supply after the same has been sanctioned ?	15. Yes.
16. What are the reasons in your opinion for such defaults ? Is It lack of funds with the party to carry out its portion of work or any other reason ?	16. (1) Lack of funds, (2) delay in getting loan from the lending institutions within a period of six months from the date of communications of power supply sanction.
17. What is the organisational set up to take care of the Rural Electrification works right from investigation and planning Stage upto the completion of the work and giving service connections ?	17. Every division has one construction sub-division for investigation and construction of Rural Electrification and I. P. works which will be in charge of upto five Junior, Engineers/Supervisors sanctioned at one Jr. Engineer/Supervisor for works worth Rs. 4 lakhs sanctioned and under progress in the year. Planning and procurement of major line material is handled at the Head office which is under a Superintending Engineer, Electricals (Technical).

SUPPLEMENTARY QUESTIONNAIRE

ANNEXURE-I

	3rd Plan	1966-67	1967-68	1968-69
1. Number of Schemes investigated	..	..	..	..
2. Schemes for which estimates were prepared :				
(a) Number of pumpsets involved	..	..	..	..
(b) Number of villages involved	..	..	..	..
3. Schemes actually included in the programme*				
(a) Number of Schemes	..	..	..	..
(b) Number of pumpsets covered	21,000	12,000	15,000	20,000
(c) Number of villages covered	970	500	500	500
4. If the number of Schemes taken up is comparatively small to the Number investigated the reason for the same : whether it is due to want of funds, non-feasibility with reference to revenue returns or any other reason.				
5. Schemes completed :				
(a) Number of Schemes	..	..	..	..
(b) Number of pumps energised	25,469	12,324	16,577	20,536
(c) Number of villages electrified	1,448	873	928	556
6. If the number of schemes completed are comparatively small, the reasons for the shortfall ; whether due to paucity of materials, in adequate organisation or any other reasons.	Does ot arise.			

*Ordinarily the number of Schemes that will be taken up for execution may not tally with the number investigated as it is a continuous process. The figures in the manner called for would be sufficiently representative.

ANNEXURE-II

	3rd Plan	1966-67	1967-68	1968-69
1. Period	1. Period			
2. No. of pumpsets programmed to be energised	21,000	12,000	15,000	20,000
3. Area estimated to be irrigated in acres	84,000	48,000	60,000	80,000
4. Estimated cost (in Rs. lakhs) of energisation of the pumpsets inclusive of sub-transmission lines were involved	..	..	..	..
5. Provision in the Plan in Rupees lakhs	338.87	345.00	390.00	366.00
6. Pumpsets actually energised :				
(a) Number	25,469	12,324	16,577	20,536
(b) Aggregated HP	1,07,438	55,093	74,966	90,293
7. Outlay incurred :				
(a) Total in Rs. lakhs	523.68	321.00	486.00	475.00
(b) Average per HP in Rs.	202.00	172.00	154.00	190.00
8. Average length of line per HP in metres :				
(a) Sub-transmission line	..	63	..	..
(b) Distribution line	..	400	..	..
9. Area brought under irrigation :				
(a) Aggregate acres	1,07,438	55,093	74,966	90,293
(b) Acres per HP	1	1	1	1
10. Estimated food production in tons per H.P.	½	½	½	½
11. Estimated revenue to the Elect. Board	173.32	65.84	90.00	147.00
12. Power tariff in paise per kWH adopted to equaluate the revenue return.	Evaluation of revenue return is not linked with tariff. However economic feasibility of arranging power supply to IP sets is based on the maximum expenditure of Rs. 1,250 per H. P. The consumer has to guarantee annual minimum revenue return of the per H.P.			
13. Percentage return on investment	4.37	4.75	4.80	6.26.

ANNEXURE-III

	Tabular steel poles		Fabricated steel poles		R C C poles		Wooden poles		I-Beams Rails	
	Subtr. line	Distr. line	Subtr. line	Distr. line	Subtr. line	Distr. line	Subtr. line	Distr. line	Subtr. line	Distr. line
1 Height of the ling support in metres	9	8	9	7.5	9	8	9	7.5	9	8
2 Span in metres	83.5	66	83.5	66	83	66	80.0	69	83.5	66
3 Size of conductor (in ACSR)	2	$\frac{2}{4}$	2	$\frac{2}{4}$	2	$\frac{2}{4}$	2	$\frac{2}{4}$	2	$\frac{2}{4}$
4 Minimum ground clearance mtrs.	7	6	7	6	7	6	7	6	7	6
5 Frequency of grounding .	(a) in case of sub-transmission line ; Every pole is grounded irrespective of type of support. (b) In case of Dist. line earthing the cont gr. wire at every sixth pole or in lieu of it every pole should be grounded.									
6 Frequency of earth guards used if any.	earth guards are provided to 11 kV and above lines at the tel line/road crossings or near the vicinity of the village.									
7 Depth of pole under ground in metres.	1.51	1.37	1.51	1.37	1.51	1.37	1.51	1.37	1.51	1.37
8 Cost in Rupees of the line per KM.	Data not available		6840	6610	7175	7185	6085	5024	8070	Data n.a.
9 Labour content in Rs			500	488	586	615	390	525	500	..

ANNEXURE-IV

Financial Assistance Obtained for Rural Electrification Including IP-Sets

1966-67	1967-68	1968-69		1969-70	
			(Lalkhs Rs.)		(Lakhs Rs.)
During 1966-67 & 1967-68 Loans were obtained from the State Government for meeting a part of the capital expenditure on Rural Electrification		State Bank . .	120	Vysya Bank . .	209
		Indian Overseas Bank .	40	Vijaya Bank . .	25
		Karnatak Bank . .	25	United Commercial .	75
		Canara Banking . Corpn.	25	Canara Bank . .	60
		Vijaya Bank . . .	25	Agr. Karnataka Bank .	50
		Allahabad Bank . .	50	Corpn . . .	50
		Agriculture Finance Corpn.	64	Corpn Agr. Reform .	50
		L. I. C. of India . . for RE and other works	200	Canara Banking Corpn .	25
				L I C of India	150 for R E and other works

Loan from Bank and Agr. Finance are repayable on the end of 5 years

Rate of interest at 8%

The L. I. C. loan is repayable in 20 yearly instalments.

Interest Rate at 7-1/4%.

WEST BENGAL STATE ELECTRICITY BOARD

PART-I

Questionnaire Regarding Rural Electrification in the State	Reply to the Questionnaire
1	2
1. Average distance (KM) to consumers well from the law tension line in electrified village.	1. 0.2 KM.
2. Average distance (KM) to a villages proposed to be electrified from the existing high tension lines upto 33 KV.	2. It varies from 0.8 KM to 1.6 KM.
3. Estimated expenditure of laying high tension line per KM (11, 22 and 33 KV).	3. (1) 11 kV.. (.03 ACSR) Rs. 7,980 per KM. (2) 22 kV (.05 ACSR) Rs. 9,050 per KM. (3) 33 kV. (.05 ACSR) Rs. 10,630 per KM.
4. Estimated expenditure for laying high tension line per KM.	4. (1) Rs. 9,940 per KM (With 6 & 8 SWG). (2) Rs. 11,830 per KM (With 3 & 6 SWG).
5. Approximate No. of consumers to be served from the transformer size (KVA).	5. No. of consumes to be served from the tran for mer in any village depends on the load demand It has got no specific relations with the capacity Generally 25 KVA, 50 KVA, 100 KVA 11/0·4 KV transformers are used. On basis of the load demand the transformer capacities are decided for the particular village.
6. What should be load factor in case of agricultural connection for preparation of estimates ?	6. 15%
7. What is the yardstick for sanctioning different categories of line staffs in Rural areas for proper maintenance ?	7. Generally one Assistant Lineman and 2 Khalasi at the time of starting a new supply station.
8. What is the procedure for attending fuse calls and maintenance in Rural area ?	8. Generally call centres are opened at suitable place of a group of electric supply undertaking. Consumers have been asked to contact the call centres of their area for attending the fuse calls.
9. Whether the internal install actions of Agricultural connection including pumps and motors are maintained departmentally or by the consumer himself ?	9. By consumers himself.
10. (a) What facility has been allowed to the Agricultural consumers for utilising the motor of pumping set for use other than irrigation ?	10. (a) No other facility is generally given to the consumers other than irrigation.
(b) In use of the agricultural pumping connection for other purposes such as farm ligthing and other appliances etc. permitted.	(b) Yes, by providing separate meter.

PART II

1. Electricity consumed pump set H.P. per year :	1. No study has yet been made in this regard. All the pumps are not run regularly because in many places the distributing channels are yet to be completed. Unless these pumps are run normally no dependable figures can be worked out about the consumption of electricity per H. P. installed capacity.
2. Annual cost per acre per crop for electric pumping for different crops :	2. No such particulars are available with us. Such figures could not be obtained from the Agriculture Department of the State Government.
3. Net return per pumps set (after taking into account transmission losses and other overheads):	3. The question is not understood, if it is the question of financial return per pump set then it will be very difficult to work out the same at the present stage in view of the fact that allocation of cost of transmission and distribution lines have not

PART-II—*Contd.*

1	2
	yet been made in this Board and the cost of energy cannot be worked out precisely. It will be appreciated that cost of energy is a very relevant factor in determining the financial return the scheme.
4. What is the system of meter reading, billing and collection of energy charges in the rural areas ?	4. The standard arrangement of meter reading, billing and collection of revenue is followed in all the rural areas. To be more specific, it is to be stated that meter reading is taken once in a month preferably in the last week. Billing is done a the nearest Group Electric Supply undertaking and the bills are issued for each supply point once in a month to the consumer. Bills are generally sent by post. Collection of energy charges is made at the specified dates at nearest Group Electric Supply Office. For the Convenience of consumers bills are also collected at the call centre which is nearer to the village on a few specified dates only.
5. What other types of agricultural processing machinaries are permissible under the agricultural tariff and upto what load ?	5. The agricultural tariff is generally applicable to pump sets. Other implement for agricultural processing are charged according to Board standard rates for small industries. So far as the pump load is concerned there is restriction upto 50 KVA. For a load beyond 50 KVA the consumer is asked to take bulk supply at high voltage.
6. At what rate electricity is supplied in villages for streetlighting :	6. The following rates are applicable for streetlights Incandescent Lamp requiring

Standard Fittings

Wattage of lamp	Rate per lamp P.M.
25 Watt	Rs. 3.00
40 Watt	Rs. 3.25
60 Watt	Rs. 4.00
75 Watt	Rs. 4.75
100 Watt	Rs. 5.75
200 Watt	Rs. 11.50

1	2
7. What is the break up of financial assistance, if any received from different Financial Institutions for Rural Electrification Schemes for the year 1966-67 and onwards ?	7. No such assistance has yet been received by us yet. Arrangement is being made to submit the scheme amounting to Rs. 250 lakhs approximately to newly formed Rural Electrification Corpn. who in turn offer this loan based upon the above schemes.
8. What was their conditions of repayment of loans and interest charges ?	8. (a) The condition of the capital repayment to the Corporation must commence after 5 years and be completed in 15 to 25 years thereafter. (b) Rate of interest of the capital should be 6% for the first 5 years and 6% thereafter for normal districts and 5% for the first 5 years and 6% thereafter for backward districts. West Bengal is being considered as backward State in regard to Rural Electrification.

सत्यमेव जयते

HARYANA STATE ELECTRICITY BOARD

PART-I

Sl. No.	Questions	Answers
	1	2
1.	Average distance (KM) to consumer's well from the low tension line in electrified village.	0.34 K.M.
2.	Average distance (KM) to a village proposed to be electrified from the existing high tension lines-upto 33 kV.	Average distance upto 11 kV=2.25 K.M.
3	Estimated expenditure of laying high tension line per K.M. (11,22 and 33 kV).	11 kV line with ACSR No. 8 SWG=Rs. 8,370 per KM 33 kV line with ACSR 0.1 sq. inch=Rs. 17,200 per KM.
4.	Estimated expenditure of laying low tension line per KM.	Rs. 9,300 per K.M. with A.C.S.R. No. 8 S.W.G.
5.	Approximate No. of consumers to be served from the transformer in any village and transformer size (KVA).	For 50 KVA transformer, 60 Nos. of G.S. connections of 250 watt each, 6 connections of cottage industries of 1 kW each and 12 tubewell each of 5 H.P. after taking into account 40% of demand factor for general load; 60% of demand factor for cottage 50% demand factor for agriculture and 1.15 as diversity factor, will be connected.
6.	What should be the load factor in case of agricultural for preparation of estimates.	On an average one tubewell runs for a period of 6months in a year working 8 hours a day. Thereafter load factor for preparation of estimate should be $\frac{6/12\times 8}{24}$ i.e. 16.6%. But this has been prescribed as 12%. However as per Board's policy the financial justification has been dispensed with in case of tubewells falling within a distance of 3 miles load factor is not rquired.
7.	What is the yardstick for sanctioning different categories of line staffs in Rural Areas for Proper maintenance ?	The yardstick for sanctioning different categories of line staff for maintenance of lines is given below :—

Type	A.F.M.	Linemen	A.L.M.
1. 11 *kV lines :*			
(a) for patrolling mtc. of 11 kV lines upto 25 Kms.	..	1	1
(b) For partolling lines from 25 to 75 Kms.	..	1	3 (1 ALM for every 25 Kms.)
(c) Above 75 Kms. upto 150 K.Ms.	1	2	6 (1 ALM for every 25 Kms. and 1 LM for every 75 Kms. or part thereof.
2. 33 *kv lines*			
(a) Upto 330 k.Ms.		As per para 1 above.	
(b) From 31 Kms. to 80 Kms.		Assistant Foreman . =1 No. Lineman . . =2 Nos. A.L.M./ . . =4 Nos. Lorry Driver = 1 No.	
(c) For length of line in excess of 80 Kms.		As per para 1 above.	
(d) This yardstick will also be applicable to 66 and 132 kV lines, except that the Assistant Foreman will be substituted by Foreman.			

सत्यमेव जयते

PART-I—*Contd.*

1	2
(e) Calculations of staff will be based on the total length of 11 kV lines in each Sub- division/Sub-Offices. (f) For 33 kV an above calculations will be based on each separate line. (g) In scattered areas *viz.* Bhiwani, Sirsa, Jhajjar, Rewari Nuh, Ferozepur Jhirka. Tehsil and Mohindergarh District Additional staff will be sanctioned on merits of each individual case.	
8. What is the procedure for attending fuse calls and maintenance in Rural areas.	Complaint centre for catering the complaints of consumers for 5 to 7 villages is generally located in the Central Village where staff is posted to register and attend the fuse calls of consumers. Complaint gang is headed by lineman with two helpers i.e. Asstt. Lineman maintenance work is carried out by the maintenance staff under the instructions of L/S as per Maintenance Schedule and the total staff or attending Maintenance work is as per yardstick given in item -7
9. Whether the internal installations of Agricultural connections including pumps and motors are maintained departmentally or by the consumer himself.	By the consumer himself.
10. What facility has been allowed to the agricultural consumers for utilising the motor of the pumping set for use other than irrigation 7 is use of the agricultural pumping connection for other purposes such as farm lighting and other applications etc.	The pumping set motors can be utilised for other Agricultural purposes under the A.P. Tariff. However, as the duty is leviable on Agricultural Industrial Load, the consumer is required to intimate the utilisation of motor for other Agriculture industries for the purpose of levy of Electricity Duty. Lighting, other than pump House Lighting is not permitted under the A. P. Tariff and as such a connection if required for farm lighting and other appliance etc. cannot be catered from the A. P. connections.

PART-II

1	2
1. Electricity consumed per pump set HP per year . . .	Total units consumed per BHP/per year : 1967-68 . . . 730 Units. 1968-69 . . . 725 Units.
2. Annual cost per acre per crop for electric pumping for different crops.	Relates to Agricultural Department.
3. Net return per pumpset (After taking into account transmission losses and other over heads).	The position regarding return irrigation tubewells in the State for the year 1968-69 was reviewed the details of which are as under :— (i) Average cost for tubewell connection . . . . . . Rs. 3,100 (ii) Average connected load per tubewell . . . . . . 6.4 BHP (iii) Average No. of units sold per Tubewell . . . . . 4640 units. (iv) Cost per unit sold including losses etc. . . . . . 22.01 paise (v) Return per unit . . . 17.5 paise

PART-II—*Contd.*

1	2
	(vi) Revenue realised per tubewell (4640 × 17·5) . . . Rs. 812 (vii) Cost on sale of power 4640 × 22·01) . . . . . . Rs. 1,021 (viii) Annual loss per tube well . 209 (ix) Percentage of loss Rs. 6.74 % The Board is therefore incurring a loss @ 6.74% per tubewell connection.
4. What is the system of meter-reading, biling and collection of energy charges in the rural areas ?	Meter reading is done by the meter readers every month in accordance with the prescribed reading cycle. After reading the meters, the readings are recorded by the Meter Readers in the Meter Reading record. This is kept in the Revenue Wing. The bills are issued from the Sub-office/Sub-Divisions in which the respective connection fall. The readings are entered in the ledger by the ledger clerks. The bills are first prepared in the ledgers and another copies in the bills for the delivery to the consumers concerned Date of payment upto which the bill can be paid at net rates is mentioned on each bill. Payment of bills is accepted at the office of issue of the bills. Cash is received at the sumers counter in the Sub office/Sub - Division from the con- during prescribed working hours. Consumers in the villages lying within the radius of 5 miles from the Sub-Office/Sub-Division headquarters are required to pay their bills at the counter in the sub-office/sub-division. In the case of villages lying beyond the radius of five miles, date of payment of bills in respect of different areas is so staggered as to adjust it with the routine tours of the S. D. O. in those particular areas where the cashier can accompany the S.D.O. in his vehicle and collect the cash in payment of bills at the time and place so fixed. This is indicated on the face of the bills by affixing a rubber stamp. Morever, in case consumers in a village or in an area can make an application this their bill may be delivered to the representative of the Panchyat at Co-operative Society and payment of the bills can also desired to be made by them through that representative at their responsibility. The representative arranges to deposit the amount of bills so collected in the Sub-Office Sub-Division concerned.
5. What other types of Agricultural processing machineries are permissible under the agricultural tariff and upto load.	Under the tariff schedule in vogue, power under agricultural pumping supply is available upto a connected load not exceeding 20 kW (25 BHP) other agricultural load e.g. wheat thrashers, toka etc. with a load not exceeding 20 KW are governed by the tariffs schedule “SP” small power supply. In case however, a thrasher is used on the motor installed for Irrigation Pumping set, tariffs “AP” Agricultural pumping supply is charged.
6. At what rate electricity is supplied in villages for street lighting.	Street, light supply is given to the Urban and Rural Areas of 18 paise per unit/month plus prescribed line Maintenance and Lamp renewal charges, However, in the case of street light supply to village Panchayats, a rebate of 25% over the Standard tariff i.e. Energy charges and line Maintenance and lamps Renewal charges is allowed.

PART-II—*Contd.*

	Answer to Question No. 7 & 8
7. What is break-up of financial assistance if any, received from different Financial Institutions for Rural Electrification schemes for the year 1966-67 and onwards ?	The break up of financial assistance received from different Financial Institution for Rural Electrification schemes from the year 1967 (as the Board came into operation on 5-2-67) onwards and the condition of repayment of loans and interest charges is given in the enclosed sheet

Sl. No.	Source	Amount of loan	Date of loan	Period of repayment	Interest (net)
		Rs.			
1.	L. I. C.	1 Crores	30-7-68	20 equal instalments within a period of 20 years from the date of drawal of loan.	7.25% P.A.
2.	L. I. C.	1 Crore	20-3-68	Do. . . .	7.25% P.A.
3.	Agricultural Finance Corporation :				
	AFC	35,00,000	8-5-69	Repayment at the end of 5th year.	8% P.A.
	BI	30,00,000	12-5-69		
	CBI	40,00,000	12-5-69		
	UBI	10,00,000	9-5-69		
	Dena Bank	5,00,000	9-5-69		
		1,20,00,000			
4.	New Bank of India . . .	30,00,000	25-4-69	5 years annual instalment of Rs. 6 lakhs each.	8% P.A.
5.	New Bank of India . . .	1 Crore	25-7-69	5 years annual instalment of Rs. 20 lakhs each.	8% P.A.
6.	Open market of issued of 12 years 6% HSEB-Bonds-1979-(First loan).	1,10,00,000	Oct./Nov. 67	will be paid at par after 12 years in 1979.	6% P.A.
7.	Open market of issued of 12 years 6% HSEB-Bonds-1980 (2nd loan).	1,65,00,000	23-10-68	will be paid at par after 12 years in 1980.	6% P.A.
8.	Open market of issued of 12 years 6% HSEB-Bonds-1980 (supply loan)	49,49,000	20-2-69	will be paid at par after 12 years in 1981.	6% P.A.
9.	Agricultural Refinance Corporation .	55,52,500	1-7-68 to 30-6-69	Seven equal yearly instalments	6% P.A.
10.	Open Market loan 1981 . . .	4,00,00,000*	Nov. 69	Payable at par after 12 years	6% P.A.

*Subscription over 6 crores have been received.

NOTE.—State Government loans to the State Elecy. Board carry 6% rate of interest. These loans are repayable to the State Government according to the priorities fixed in the Elecy. Supply Act, 1948.

STUDY GROUP ON RURAL ELECTRIFICATION POWER ECONOMY COMMITTEE

HARYANA STATE ELECTRICITY BOARD

Supplementary questionnaire	Answer
1	2
1 What are the criteria used in the planning of energisation of IP sets and village electrification in the Plan periods and the annual plans ? It is on the basis of existing wells in the State or on a pre-determined number comprising the existing wells and those that may come up during the course of the plan periods ?	1. The criteria used in the Planning of energisation of IP sets and village electrification in the Plan periods and annual plan is on a pre-determined number comprising the existing wells and those that may come up during the course of plan periods i.e. pending applications etc. village electrification is done on the basis as :— (1) Population bigger population villages to be electrified first. (2) Nearness of the villages the existing net work and those which fall enroute the 11 kV lines, and (3) The loan developed in the area.
2 Whether the vicinity of the existing distribution.......... ....lines would form an important basis or irrespective of the existence of the lines, wells are chosen on the demand of agriculturists ?	2. The energisation of wells is carried out on the demand of the agriculturists, pending application from the prospective consumers etc.
3 Selection of wells made in consultation with other departments such as Revenue Department, Agriculture Department etc. ? If so, the procedure adopted may be briefly indicated ?	3. No. the selection of wells to be energised is on the pending demand from the prospective consumers. However, energisation of tubewells is is also carried out under the advice from the Agricultural Department of State on the basis of the schemes covered under Agriculture Refinance Corporation.
4 What are the rules governing the sanction of works pertaining to energisation of pumpsets and electrification pumpsets and electrification of villages ? Is it on the basis of minimum returns. If so what is the minimum return estimated ? The proforma Annexure I and II attached herewith may be replied.	4. In the energisation of pumpsets and electrification of villages following are the rules governing the sanction of the above works. (1) As per the crash programme or energisation of tubewells being inform in the Board all the tubewells which fall within three miles radius from the existing source of supply of the Board i. e. 11 kV and 440 volts, will be given connections irrespective of the financial justification. However, the prospective consumer is required to enter into an agreement for minimum consution/guarantee for a period of 5 years @ Rs.7 per BHP per year. (2) For electrification of villages, the minimum return should be such that at the end of 10th year of operation, the net revenue return should be 6·25% of the total commulative capital outlay at the end of that year. The reply to Annexure I and II attached.
5 Please furnish the constructional details in respect of sub-transmission and distribution lines in proforma Annexure III.	5. The constructional details in respect of sub-transmission and distribution lines have been furnished in proforma Annexure III.
6 What are the sizes of distribution transformers generally used ? Drawing showing standard installation of transformer centres may be furnished showing the scheme of connections on the HT and LT lines, distribution boxes etc.	6. The size of distribution transformers in general use are 25 KVA, 40 KVA and 100 KVA. The drawing showing the scheme of connection is attached.
7 What is the cost of transformer centre installation for various capacities in general use. The labour content in each may be separately shown.	7. The cost of various capacities of transformer centre including H-Pole, structure, G. O. switch lighting Arrest or and cable etc. which are generally in use is as under :—

Transformer capacity	Cost
	Rs.
25 KVA . . .	6,020
40 KVA	6880
63 KVA	9,425
100 KVA	9,716

Labour charges for erection of a 25 KVA to 100 KVA are Rs. 384 for each transformer.

सत्यमेव जयते

HARYANA STATE ELECTRICITY BOARD—*Contd.*

1	2
8. The following may be furnished in respect of the LT distribution lines and the method of voltage control.	
(a) Maximum length of any branch extended from the transformer centre in metres.	(a) 20 spans of 40 metres each average.
(b) Size of Phase conductor	(b) The minimum size is 88 WG, A.A.C. and maximum size is A.C.S.R. 5 S.W.G.
(c) Load permitted	(c) 10 KW on 8 S.W.G. and 16 K.W. on 5 S.W.G· connected at the end and average a distributed load of 20 K.W. on 8 S.W.G. and 32 K W. on 5 S.W.G. respectively is permitted.
(d) Minimum no load voltage on the H.T. and L.T. sides of the transformer generally obtaining in the system.	(d) + — 8%
(e) The method of tap changing of the power transformers in the substations, whether off load or on load.	(e) *H.T. Side* — *L.T. Side* Maximum on load 12 KV . 450 volts. Minimum on load 9 KV . 340 Volts.
(f)(i)	(f)(i) Off load method.
(ii) Whether any booster transformers and auto transformers have been used on long sub-transmission lines if so the range of voltage regulation of such transformers.	(ii) No.
(iii) Whether any capacitors have been used for P.F. and voltage improvement and the scope of their influence.	(iii) No.
9. What are the normal channels of financing ? Details may be furnished showing the agencies from which finances are raised, the interest charges, important terms of advancing the funds, whether such terms are favourable or not etc.	9. The normal channel of financing consists of Institutional open market and Government loan, the details furnishing the agencies from which finances were raised, period of repayment and their interest charges are enclosed. As regards terms of advances, these are sanctioned either on Government guarantee or on hypothecation of the Board's Assets. For example, Agriculture Refinance Corporation is making advance of Rs. 2,500 to the Board on the individual tubewells on behalf of the farmer concerned. Similarly, Agricultural Finance Corporation have also sanctioned recently an advance under the Re-imbursement method. As per terms of this advance, expenditure incurred by the Board on irrigation pump set connection will be reimbursment subject to a maximum of Rs. 3,000 per connection. Period of payment of various advances varies from 5 years to 20 years. The advances are usually not found so favourable. In case of Institutional advances specially from Banks, repayment is desired in 5 years period which is very short. Also rate of interest charged for various loans is very high. It is 6% in case of State Government Loans and goes upto 8% on loans from Banks. Heavy rate of interest renders the programme of Rural Electrification uneconomic for the Board.
10. What is the average cost per H.P. for supplying power to the Agriculturist ?	10. The average cost per H.P. for supplying power to the agriculturist works out to Rs. 487 as per details enclosed.
11. What is the power tariff in respect of Agricultural loads ?	11. The power tariff for tubewell connection for agriculture loads is :— Demand charges @ Rs. 1.50 per BHP /month plus energy charges @ 15 paise per Kwh/month.
12. What will be cost of energy Kwh at the agriculturist end ?	12. The cost of energy/kWH at the agriculturist end works out to 20.18 paise per unit as details enclosed for Q. No. 10 above.
13. What are the financial invovlements to the Agriculturist in regard to wiring of his installation etc. before he is able to obtain power service from the Board ?	13. The financial involvements involved in the internal wiring of the installation of an agriculturist is not known to the Board because it relates to the consumer himself. However, the agriculturist is required to spend for boring of the well, installation of pumpset and its wiring upto the meter Board and afterwards submit a rest report of his installation complying with I.E. Rules.
14. In the event, the Board is incurring a loss when viewed from venkata Raman Committees recommendation on this account is it being subsidised by the State Government or how is it being dealt with.	14. The Board is running at almost no profit and no loss basis. The Venkataraman Committee report states that in the first instance, the Board should run at no profit and no loss and in the 2nd stage a profit of 3% on the capital base

HARYANA STATE ELECTRICITY BOARD—*Contd.*

1	2
should be earned; the board has therefore fulfiled the first point of recommendation of the above report.	It is also pertinent to mention that the Board is sustaining heavy financial losses in supplying power to tubewell, which is not being subsidised by the State Government. The total losses during 1968-69 were of the order of about 66 lacs. In case the loss is subsidised by the State Government, the financial working of the Board can further improve.
15. Are there any cases of defaults on the part of the agriculturist in availing power supply after the same has been sanctioned ?	15. Yes. There are some cases where the connections are not taken due to default on the part of consumer after the same have been sanctioned to them.
16. What are the reasons in your opinion for such defaults ? If it lack of funds with the party to carry out its portion of work or any other reason ?	16. In most of the cases, the reason is that connections are not taken due to paucity of funds. In some cases, the connections are also not taken due to failure of tubewell bores.
17. What is the organisation set up to take care of the Rural Electrification works right from investigation and planning stage upto the completion of the work and giving service connections ?	17. A planning cell headed by one XEN. has been created by the board who is responsible for over all control on the Rural Electrification in the State Haryana. This cell is engaged in planning yearwise the electrification of certain villages and pumping sets depending, upon the requirement of load (for which physical investigation is done and on the load applied for), population group of the villages, the availability of lines existing nearby etc. The projects reports for these planned electrification works are prepared and got sanctioned and on the basis of the sanctioned project financial assistance is asked from different institutions. The operation organisation inturn, who is responsible for the actual execution of the job in the field for such rural electrification programme is handed over such planned works for execution. The watch is kept for the progress achieved every month. This service connection etc. are released to the consumers as and when required by individual consumser.

ANNEXURE-I

	Third Plan	1966-67	1967-68	1968-69
*1. Number of Scheme investigated	..	..	..	..
2. Scheme for which estimates were prepared :				
(a) No. of pumpsets involved	..	..	..	..
(b) No. of villages involved	..	..	..	..
3. Scheme actually included in the programme :				
(a) Number of schemes		..	..	..
(b) Number of pumpsets covered	..	..	..	..
(c) Number of villages covered	..	..	..	..
4. If the number of schemes taken up is comparatively small to the number investigated, the reason for the same, whether it is due to want of funds, non-fearibility with reference to revenue returns or any other reason	..	..	..	..
5. Schemes completed :				
(a) Number of Schemes	..	..	..	..
(b) Number of pumps energised	..	..	..	..
(c) Number of villages electrified	..	..	..	..
6. If the number of schemes completed are comparatively small, the reasons for the shortfall, whether due to paucity of materials, inadequate organisation or any other reason	..	..	..	..

---

*Ordinarily the number of schemes that will be taken up for execution may not tally with the number investigated it is a continuous process. The figures in the manner called for would be sufficiently representative.

ANNEXURE-II

1 Period	Third Plan	1967-68	1968-69
2. Number of pumpsets programme to be energised		7,000	20,000
3. Area estimated to be irrigated in acres	No such estimates are prepared		
4. Estimated cost (in Rs. lakhs) of energisation of the pump sets inclusive of sub-transmission lines where involved.		280	800
5. Provision in the Plan in Rupee lakhs		280	800
6. Pump sets actually energised :			
(a) Number	*	7,399	19,123
(b) Aggregate HP		33,814 KW	87,320 KW
7. Outlay incurred :			
(a) Total in Rs. lakhs		*230 lacs (approx).	*600 lacs (approx.)
(b) Average per H.P. in Rs. :		Rs. 515 (Approx.)	..
8. Average length of line per HP in meters :			
(a) Sub-transmission line (b) Distribution line	No such a statistics are maintained for tubewell connections.		
9. Area brought under irrigation :			
(a) Aggregate acres (b) Acres per HP	No such a statistics are maintained for tubewell connections.		
10. Estimated food production in tons per HP	No such estimates are maintained with Board.		
11. Estimated revenue to the Electricity Board	Rs. 812 per tubewell, per year.		
12. Power tariff in paise per kwH adopted to evalbate the revenue return.	Demand charges @ Rs. 1.50 per BHP per month *plus* energy charges @ 15 per unit.		
13. Percentage return on investment	8.7% on the average capital for the Board as a whole.		

*The figures are exclusive of the sub-transmission system.

ANNEXURE-III

Reply to Question Number 5 :

	Tabular steel poles		Fabricated steel poles		R. C. C. Pole		Wooden Poles		Any other kind of Poles	
	Subtr. line (11 kV)	Distr. line (440 V)	Subtr. line (11 kV)	Distr. line (440 V)	Subtr. line (11 kV)	Distr. line (400 V)	Subtr. line (11 kV)	Distr. line (400 V)	Subtr. line (11 kV)	Distr. line (400 V)
Height of the line support in metres.	9.75	8.19.9.1	9.1	8.19.9.1	9.1	8.19	9.75	9.1	..	..
Span in metres	100	85	100	85	100	85	100	85	..	..
Size of Conductor	ACSR No. 8 SWG	A.A.C. No. 8 SWG	ACSR No. 8 SWG	A.A.C. No. 8 SWG	ACSR No. 8 SWG	A.A.C. No. 8 SWG	ACSR No. 8 SWG	A.A.C. No. 8 SWG	..	..
Minimum ground clearance (metres).	For 11 kV—15 feet in rural areas and 20 feet across roads. For I. T.—15 feet in rural areas and 19 feet across roads.									
Frequency of earth guards used if **any.**	Normally every 5th pole is earthed, and L.T., lines—on road crossing.									
Depth of pole underground	1/6th of the total height of the pole.									
Cost in rupees of the line per K.M.	9,000	7,695	5,600	6,200	7,768 with mild steel 7,460 with tor steel	5,589 with mild steel 5,535 with tor steel	8,878	6,369	..	..
Layout content	1,223	1,368	91,750	1,368	1,223	1,368	1,223	1,368	..	..

Reply to Question Number 9

Sl. No.	Source	Amount of loan	Date of loan	Period of repayment	Interest rate (net)
		Rs.			
1	L. I. C.	1 Crore	30-7-68	20 equal instalments with a period of 20 years from the date of drawal of loan.	7.25%
2	L. I. C.	1 Crore	20-3-69	Do.	7.25% P.A.
3	Agricultural Finance Corporation				
	AFC	35,00,000	8-5-69	Repayment at the end of 5th year.	8 %
	BI	30,00,000	12-5-69		
	CBI.	40;00,000	12-5-69		
	UBI	10,00,000	9-5-69		
	Dena Bank	5,00,000	9-5-69		
		1,20,00,000			
4	New Bank of India. . . .	30,00,000	25-4-69	5 years annual instalment of Rs. 6 lacs each.	8% P.A.
5	New Bank of India . . .	1 Crore	25-7-69	5 years annual instalment of Rs. 20 lacs each.	8% P.A.
6	Open market of issue of 12 years 6% HSEB Bonds 1979 (first loan).	1,10,00,000	Oct./Nov. 1967	Will be paid at par after 12 years in 1979.	6% P.A.
7	Open market of issue of 12 years 6% HSEB Bonds 1979.	1,65,00,000	23-10-68	Will be paid at par after 12 years in 1980.	6% P.A.
8	Open market of issue of 12 years 6% HSEB Bonds 1980	49,49,000	20-2-69	Will be paid at par after 12 years in 1981.	6% P.A.
9	Agricultural Refinance Corporation .	55,52,500	1-7-68 to 30-6-69	Seven equal yearly instalments	6% P.A.
10	Open market loan 1981 . . .	4,00,00,000	Nov. 69	Payable at par after 12 years	6%

*Subscription over 6 crores have been received 12 years.

NOTE.—State Government loans to the State Elecy. Boards carry 6% rate of interest. These loans are repayable to the State Government according to the priorities fixed in the Electricity Supply Act, 1948.

Reply to Question Number 10 *and* 12 :

1.	Mean connected load during 1968-69	173492 KW
2.	Mean Number of connections during 1968-69	3,6557
3.	Connected load per connection	4.75 kW or 6.37 BHP
4.	Units sold during 1968-69	1686.22 lacs.
5.	Average Number of units sold for a tubewell during 1968-69	4640
6.	Average expenditure incurred by the Board for giving tubewells connections .	Rs. 3,100
7.	Average expenditure per BHP	$\frac{3,100}{6.37}$ = Rs. 487
8.	Annual expenditure @ 17 (interest 6% Depreciation 4½% O. & M. 6% Genl. Reserve ½%)	Rs. 527
9.	Cost per unit on account of capital expenditure	11.36 paise
10.	Grid cost per unit at 33 kV grid	7.31 paise
11.	Cost of supply at consumer (taking loss of 20%)	8.77 paise
12.	Total cost of supply per unit	20.13 paise
13.	Cost per BHP	Rs. 146.63

RAJASTHAN STATE ELECTRICITY BOARD

PART-I

Questionnaire Regarding Rural Electrification in the States	Reply to the Questionnaire
1	2
1. Average distance (Km) to consumer's well from the low tension line in electrified village.	1. The wells are located generally at an average distance of 4 Km from the L.T. lines in the electrified locality.
2. Average distance (Km) to a village proposed to be electrified from the existing high tension lines upto 33 kv.	2. The villages generally all in a distance of 1 to 4 kms. from 11 kv lines and upto 35 Kms. from 33/11 kv sub-stations.
3. Estimated expenditure of laying high tension line per KM (11, 22 and 33 KV).	3. The average estimated cost of 11 kv and 33 kv lines is as follows: The 22 kV voltage is not in vogue.

Cost of 11 KV lines Per Km.	Cost of 33 KV lines per Km.
Rs. 8,750	Rs. 15,062

4. Estimated expenditure for laying low tension lines per Km.	4. The average estimated cost of 3 phase 4 wire L.T. lines comes to Rs. 9,400 per Km.
5. Approximate No. of consumers to be served from the transformer in any village ; and transformer size (KVA).	5. The number of consumers varies according to the type of village. If there are more pucca domestic houses, shops the connections or domestic light and fans will be more, where there are only agricultural connections, the No. depends on the revenue area of the village, land holdings by agriculturists, and the water potential. The average number of agricultural connections vary from 8 to 20 per village. The number of consumers per transformer varies as per the load per connection. As regards the agricultural connections the average H.P. of a pump set in the south eastern zone of Rajasthan is 5 H.P. and in the north western zone of Rajasthan it is 10 H.P. on account of depth of sub-soil water. The approximate number of agricultural connections per 11/.4 KV transformer of 25 KVA comes to 6 in south eastern zone and 3 in north western zone.
6. What should be load factor in case of agricultural connection of estimates ?	6. The load factor in case of agricultural connections is taken as 15% for estimation purposes.
7. What is the yardstick for sanctioning different categories of line staff in Rural Areas for proper maintenance.	7. O. & M. PATTERN NO. 7 :—OPERATION AND MAINTENANCE OF LOCAL DISTRIBUTION LINES. SERVICE MAIN AND CONSUMER SERVICING :

Staffing Pattern

Code No.	Category	Designation	No. of posts
OMP	In a locality having upto 10 consumers.	..	Nil
7.1	From 11 to 80 consumers .	Lineman II or Wireman II	
	From 81 to 200 consumers .	Lineman II or Wireman II	1
		1. Helper .	1
			2
	From 201 to 400 consumers .	Lineman II or Wireman II	1
		Helper-I . .	1
		Helper-II . .	1
			3

PART-I—*Contd.*

1	2
8. What is the procedure for attending fuse calls and maintenance in rural areas ?	8. One fuse replacer is posted to attend consumers connected to 4 to 5 11/·4 kV Sub-stations. The line staff attends to the maintenance of distribution lines and sub-stations in routine in case of faults these are attended on intimation from consumers.
9. Whether the internal installations of agricultural connection including pumps and motors are maintained departmentally or by the consumer himself.	9. The installations beyond the energy meter in a consumer premises are maintained by the consumers themselves.
10. What facility has been allowed to the agricultural consumers for utilising the motor of the pumping set for use other than irrigation ? Is use of the agricultural pumping connection for other purposes such as farm lighting and other appliances etc. permitted?	10. Generally there are open wells and the motor pump set installed from 30 ft. to 60 ft. below the ground level inside the well and it is not possible to use this motor for other purposes Chaff cutters, Threshing, venoing and other agro industry are permitted from the agricultural connection which have to be got included in the sanctioned load. Lights upto 100 Watt are permitted from each agricultural connection.

PART-II

1. Electricity consumed per pumpset HP per year .	1. The Average electricity consumed per pump set H.P. year for various years is as under : (i) 1965-66 . . . . . 553 Kwh/b.h.p./year (ii) 1966-67 . . . . . 439 Kwh/do. (iii) 1967-68 . . . . . 460 Kwh/do.
2. Annual cost per acre per crop for electric pumping for different crops.	2. Not available.
3. Net return per pumpset (after taktng into account transmission losses and other overheads).	3. Not available.
4. What is the system of meter-reading, billing and collection of energy charges in the rural areas ?	4. The meters are installed at each service, and are read by the meter reader once in every month on or about a fixed date, and the bills are prepared on the basis of such records as per tariffs in vogue by the sub-division. Such bills are delivered to the consumers mostly by messengers. For collection of revenue places as sub-centres for collection, have been fixed by the Board, and the cashier goes to such sub-centres on fixed dates for specific days, and the consumers make payment to the Cashiers. The consumer can also make payment by cheque and money orders.
5. What other types of Agricultural processing machineries are permissible under the agricultural tariff and up to what load ?	5. Chaff cutting machines, are allowed under Agricultural tariff. No definite limit has been prescribed for such loads.
6. At what rate electricity is supplied in villages for street lighting.	6. The rate of street lighting being charged is at 28 NP per Kwh with the minimum charges of Rs. 2 per point per month. The above rate is net. In the event that the monthly bill is not paid in full within the period prescribed on the bill a surcharge, of 5% for first 30 days or a part thereof and 2% for each additional 30 days successive period or part thereof shall be levied on the total amount of the monthly bill, file the amount is paid in full.
7. What is the break-up of financial assistance if any, received from different Financial Institutions for Rural Electrification Schemes for the year 1966-67 and onwards ?	7. The expenditure on Rural Electrification works for the year 1966-67 and onwards are partly from Government loan, borrowing from Life Insurance Corporation and Open Market.
8. What was their conditions of re-payment of loans and interest charges ?	8. The terms and conditions of the loan are as follows :— (a) *Interest on Government Loans :* The matter is under consideration with the Government. The Government is charging a coverage charges @ 1% over the loan given by the Government of India.

PART-II—*Contd.*

1	2
	(b)(i) *Loan from L. I. C. :* (i) Previously the Board was to mortgage the assets with L.I.C. three times of the depreciated cost. of the assets against the amount of the loan required. Now the Board is to mortgage its assets twice the depreciated value against the amount of loan required. (ii) In the year 1966-67 the Board borrowed a sum of Rs. 200 lakhs (two hundred lakhs) from L. I. C. on which the rate of interest was 7½% with a rebate of ½% for prompt payment This loan was for 15 years and repayable in lump-sum or in 5 equal instalments after 10 years. (iii) The subsequent loans taken during the year 1967-68 1968-69 mounting to Rs. 100 lakhs (one hundred lakhs each year are repayable in twenty equal instalments and the rate of interest on these loans is 7¾% with ½% rebate for prompt payments. (iv) The assets mortaged are to be insured with the L. I. C. for all the loans. (v) All legal expenses are to be borne by the Board for all the loans. (c) *Open Market Loans :* In the year 1968-69 the Board floated the open market loan on the terms and conditions as recommended by the Reserve Bank of India and approved by the Government of Rajasthan. The loan is guaranteed by the Government of Rajasthan The terms are as under : (i) Currency . . . . 12 years. (ii) Issue price . . . 98% (iii) Rate of Interest . . . 6% The Board also paid 75 paise per cent as brokerage and underwriting commission to the subscribers. For the development of Rajasthan the above sources are explored for financing the Rural Electrification Programme.

सत्यमेव जयते

STUDY GROUP ON RURAL ELECTRIFICATION-POWER ECONOMY COMMITTEE

Supplementary Questionnaire	Reply to the Questionnaire
1. What are the criteria used in the planning of energisation of IP sets and village electrification in the plan periods and annual Plans ? Is it on the basis of existing wells in the States or on a pre-determined number comprising the existing well and those that may come up during the course of the Plan periods ?	1. During the 1st and 2nd plans the electrification of major town was considered. The electrification of the localities having population of more than 5,000 were considered during the Third Plan Period. The localities which have got high agricultural potential and number of wells and are close to our existing 11 KV Sub-transmission system are being considered for electrification during the annual plan periods.
2. Whether the vicinity of the wells to the existing distribution lines would form an important basis or irrespective of existence of the lines wells are chosen on the demand of the agriculturists ?	2. The wells/localities which fall in close vicinity to the exitiing distribution system for which demand is being received are considered for electrification.
3. Is the selection of wells made in consultation with other departments such as the Revenue Department, Agricultural Department, etc. ? If so, the procedure adopted may be briefly indicated.	3. The connections to the wells are given to the agricultrurits who make a demand for it in the electrified localities only. Other departments are not consulted for this.
4. What are the rules governing the sanction of works pertaining to energisation of pump sets and electrification of villages ? Is it on the basis of minimum returns ? If so, what is the minimum return which entitles a work to be sanctioned ? How is the minimum return estimated ? The proforma Annexure I and II attached herewith may be replied.	4. For sanctioning the electrification of village or energisation of the pump sets depends on the Gross Revenue Return expected from the proposed connections. If the revenue from a village/wells is expected to be 15% of the capital investment the work is sanctioned and is considered as financialy feasible. It does not take into account the cost of 33 KV lines and above. The minimum return is worked out on the basis of the anticipated revenue with respect to the estimated cost.
5. Please furnish the constructional details in respect of the sub-transmission and distribution lines in the proforma Annexure III.	5. Details are given in the enclosed proforma.
6. What are the sizes of Distribution Transformers generally used ? Drawings showing standard installations of transformer centres may be furnished, showing the scheme of connections on the HT and LT sides, distribution boxes etc.	6. The distribution transformers 11/·4 KV are generally of the capacity of 25, 50 & 100 KVA. The drawing showing the pole mounted Sub-station is enclosed
7. What is the cost of Transformer centre installations for various capacities generally in use. The labour content in each may be separately shown.	7. The cost of 11/.4 KV pole Mounted Sub-stations is given below :—

सत्यमेव जयते

		100 KVA	50 KVA	25 KVA
		Rs.	Rs.	Rs.
Cost of Transformer sub-stations. Structure & Accessories		9,370.00	7,870.00	6,370.00
Labour charges .	10%	2,623.60	2,203.60	1,683.00
Storage . . .	5%			
Contingencies .	3%			
Transportation Charges . . .	2%			
T & P Charges .	2%			
Establishment Charges . . .	5%			
Audit & Accounts charges . .	1%			
	28%	11,993·60	10,073·60	8,053·00
		Say Rs. 12,000·00	Say Rs. 10,000·00	Say Rs. 8,000·00

Supplementary Questionnaire	Reply to the Questionnaire
8. The following may be furnished in respect of the LT distribution lines and the method of voltage control.	8.
(a) Maximum length of any branch extended from the Transformer Centre in metres.	(a) The LT lines are generally extended to maximum length of 1 km from the 11/.4 KV Sub-station.
(b) Size of phase conductor	(b) AAC-Lady, Bird, Iris & Rose.

STUDY GROUP ON RURAL ELECTRIFICATION—POWER ECONOMY COMMITTEE—*Contd.*

1	2
(c) Load permitted	(c) About 20 to 30 H. P.
(d) Voltage drop permitted	(d) 5%
(e) Minimum no load voltage on the HT and . sides of the transformer generally obtaining in the system.	(e) Minimum voltage on no load is generally in the close vicinity of 11 KV and on the L.T. side it is about 410 volts.
(f)(i) The method of tap changing of the power transformers in the substations, whether off load or on load.	(f)(i) The 11/4 KV Distribution transformers are generally having off load Tap Changers.
(ii) Whether any booster transformers or auto transformers have been used on long sub-transmission lines if so, the range of voltage regulation of such transformers.	(ii) The voltage booster transformers are being used at some places at 11 KV with a voltage regulation of +5% and 15%
(iii) Whether any capacitors have been used for P. F. and voltage improvement and the scope of their influence.	(iii) The capacitors are being used for improving the power factor and the voltage in the rural areas. Where there is more of inductive load on account of pumping sets the capacitors are required.
9. What are the normal channels of financing ? Details may be furnished showing the agencies from which finances are raised, the interest charges, important terms of advancing the funds, whether such terms are favourable or not etc.	9. Reply to this is covered under items 7 & 8 of Part II of the original questionnaire.
10. What is average cost per H.P. for supplying power to the Agriculturists ?	10. The average cost per H.P. for supplying power to the agricultural pump set varies rom Rs. 400 to Rs. 500 considering the cost of L.T. line required to be extended for (connecting the particular pump only.
11. What is the power tariff in respect of agricultural loads ?	11. The energy charges levied from an agrriculturists are 13 per KWH with a rebate of 1 P. per KW for making payment by due date. A general surcharge@ 10% on the gross rate is levied. The electricity duty is exempted to this category of consumers.
12. What will be the cost of energy per KWH at the agriculturist end ?	12. Not available.
13. What are the financial involvements to the agriculturists in regard to wiring of his installation etc. before he is able to obtain power service from the Board ?	13. The installation and wiring etc. of a pump set is got done by the agriculturist himself through a licenced contractor in which the Rajasthan State Electricity Board is not involved. This expenditure is estimatd to vary from Rs. 2,500 to Rs. 3,000 including the motor pump set of 5 H. P. to 7·5 H.P.
14. In the event the Board is incurring a loss when viewed from Venkata Raman Committee's recommendation on this account, is it being subsidised by the State Government or how is it being dealt with ?	14. The Government is not subsidising for rural/well electrification and the Board has to sustain loss.
15. Are there any cases of default on the part of the agriculturist in availing power supply after the same has been sanctioned.	15. In certain cases when the agriculturist fails to obtain finances for putting up a pumping set, he is not able to obtain the connection.
16. What are the reasons in your opinion for such defaults ? Is it lack of funds with the party to carry out its portion of work or any other reason ?	16. do.
17 What is the organisational set up to take care of the Rural Electrification works right from investigation and Planning stage upto the completion of the work and giving service connections ?	17. There are construction cum survey investigation division in each circle, which carry out the work for survey of new locations for which demand is coming up for electrification. The construction division prepares the rural electrification schemes and these schemes are further examined in the office of the Superintending Engineer and after processing in the office of the Superintending Engineer (P & RE) these schemes are sent to the Secretary, Rajasthan State Electricity Board, Jaipur through Chief Engineer/Additional Chief Engineer. These schemes are considered in the Board for conveying administrative as well as financial sanction for carrying out the work of electrification of localities. When a village is sanctioned for electrification the work is carried out by the construction of O & M division. The O & M sub-division sanctions and gives connection as per the demand of the agriculturists.

SUPPLEMENTARY QUESTIONNAIRE

ANNEXURE-I

	Third Plan	1966-67	1967-68	1968-69
1. Number of Schemes investigated	1. Not available.			
2. Schemes for which estimates were prepared	2.			
(a) No. of pumpsets involved	(a) Not available.			
(b) No. of villages involved	(b) Not available.			
3. Schemes actually included in the programme*	3.			
(a) Number of Schemes	(a) Not available.			423
(b) No. of pumpsets covered	(b) Not available.			
(c) No. of villages covered	(c) 1,036	535	6	425
4. If the number of schemes taken up is comparatively small to the number investigated, the reason for the same ; whether is is due to want of funds, non-feasibility with reference to revenue returns or any other reason.	4. Since the schemes invesigated are not available this information cannot be given.			
5. Schemes completed :	5.			
(a) No. of schemes	(a) Not available.			
(b) No. of pumps energised	(b) Not available.			
(c) No. of villages electrified	(c) 1,111	604	61	315
6. If the number of Schemes completed are comparatively small, the reasons for the shortfall ; whether due to paucity of materials, indequate organisation or any other reason.	6. During the three annual plan period, the achievemets were slighty lower than the targets for the electrification of localities dues to the paucity of funds.			

NOTE : The total No. of wells energised during this period are given below :—

Third Plan	1966-67	1967-68	1968-69
6,861	3,688	3,196	5,050

---

*Ordinarily the number of Schemes that will be taken up for execution may not tally with the number investigated as it is a continuous process. The figures in the manner called for would be sufficiently representative.

सत्यमेव जयते

ANNEXURE-II

Supplementary Questionnaire	Reply to the Questionnaire			
	Third Plan	1966-67	1967-68	1968-69
1. Period	1.			
2. No. of pumpsets programme to be energised	2.	4,000	4,000	4,910
3. Area estimated to be irrigated in acres	3. Not available.			
4. Estimated cost (in Rs. lakhs) of energisation of the pump sets inclusive of sub-transmission lines where involved.	4. Rs. 5,000 to Rs. 6,000 for energisation of a pumpset including proportionate expenses of 11 KV and 11/.4 KV Sub-station.			
5. Provision in the Plan in Rupees lakhs	5. Not available.			
6. Pumpsets actually energised	6.			
(a) Number	(a) 6,861	3,688	3,196	5,050
(b) Aggregate HP	(b) Not available.			
7 Outlay incurred :	7.			
(a) Total in Rs. lakhs	(a) Not available			
(b) Average per HP in metres	(b) Not available.			
8. Average length of line per HP in metres :	8.			
(a) Sub-transmission lines	(a) Not available.			
(b) Distribution line	(b) Not available.			
9. Area brought under irrigation :	9.			
(a) Aggregate acres	(b) Not available.			
(b) Acres per HP	(b) Not available.			
10. Estimated food production in tons per HP	10. Not available.			
11. Estimated revenue to the Electricity Board	11. Commercial.			
12. Power tariff in paise per KWh adopted to evaluate the revenue return.	12. 12 paise per K. W. H.			
13. Percentage return on investment	13. Not available.			

ANNEXURE-III

	Tabular Steel Poles		Fabricated Steel Poles		R.C.C. Poles		Wooden Poles		Any other kind of poles		
	Sub-Trans-mission line 33 kV/11 kV	Distri-bution lines	Sub-trans-mission line 33 kV/11 kV	Distri-bution lines	Sub-transmission lines	Distribution line 33/11 kV	Sub-trans-mission line 33/11 kV	Distri-bution lines	Sub-transmission lines 33/11 kV 150 × 73 mm 100× 116 mm 90lb rail 150×73 mm		Distribution lines
1	2	3	4	5	6	7	8	9	10		11
1. Height of the line support in metres	Not in use		Not in use	Not in use	271	24′	Not in use		30′	27-	24′
2. Span in metres . .	Do.		Do.	Do.	300′	150′ to 200′	Do.		400′	300-350′	150′-200′
3. Size of conductor . .	Do.		Do.	Do.	Weasel to Mink 0.03 cu.eq. in all phase	AAC lady bird in phases & rose for neutral	Do.		Raceoon 0.075 cu.eq.	Weasel to Mink	Lady bird for phase & rose for neutral
4. Min. ground clearance in metres	Do.		Do.	Do.	19′ in urban 17′ in rural	17′ in urban 15′ in rural	Do.		19′ in urban 17′ in rural	19′ in urban 17′ in rural	17′ in urban 15′ in rural
5. Frequency of grounding .	Do.		Do.	Do.	After every four poles One/km	4 in one mile	Do.		4 in one mile	4 in one mile	4 in one mile
6. Frequency of earth guards used if any	Do.		Do.	Do.	One/km	One/km	Do.		One/km	One/km	One/km
7. Depth of Pole. . .	Do.		Do.	Do.	5′	4.5′	Do.		6′	5′	5′
8. Cost in Rs. of the line per Km.	Do.		Do.	Do.	Rs. 8,750 per km.	Rs. 9,400 per km.	Do.		Rs. 15,062.50 per km.		..
9. Labour content . .	Do.		Do.	Do.	10%	10%			10%		15%

BIBLIOGRAPHY

1. Nuclear-Powered Agro-Industrial Complex (Abstract); Bhabha Atomic Research Centre, Bombay, India 1970.
2. Report on a Seminar on Energy Policy and Energy Economy held in Berlin from 9th October to 2nd November, 1968.
3. Impact of Rural Electrification in Punjab; National Council of Applied Economic Research.
4. Economics of Rural Electrification in Kerala; National Council of Applied Economic Research.
5. Annual Review; Research Scheme on Power Central Board of Irrigation and Power, 1969.
6. Symposium on Single Wire Earth Return System for Rural Electrification, Central Board of Irrigation and Power, Publication No. 87.
7. Atlas of Australian Resources, Second series Electricity Second Edition, Geographic Section, Depart of National Development, Canberra, 1969.
8. Electricity and economic development of Madras State by K. S. Sonachalam.
9. Report of the All-India Rural Credit Review Committee under the chairmanship of B. Venkatappiah-December, '69.
10. R.E.A. Bulletins.
11. Proceedings—"Conference on Standardisation of specifications construction materials in Rural Electrification held on 4th and 5th January, 1971."
12. Symposium on Energy Losses in Power Systems, C.B.I.&P. Publication No. 108-Nov., 1970.
13. Standardisation Report of E.R.E.B.
14. Standardisation Publications of C.W.&P.C.
15. Agricultural Green Resolution in U.S.A. 1940.
16. Rural Electrification in India (A broadcast talk by Dr. K. L. Rao, Union Minister for I & P).
17. Report on Evaluation of the Rural Electrification Programme, P.E.O. Planning Cimmission, 1965.
18. Bulletins of the Geological Survey of India, No. 26-Groundwater Resources of India, Present Status and suggested lines of future investigation by G. C. Chaterji-Geological Survey of India.
19. Venkataram Committee on Electricity Rates.
20. Rural Electrification vis-a-vis its use in Agriculture by Prof. H. C. Guha, Vice Chancellor Jadavpur University, Calcutta-32 HPC VII 1968 Moscow E(1).

सत्यमेव जयते

GIPN—S5—3 M. of I. & P./71—17-11-72—1000.

सत्यमेव जयते